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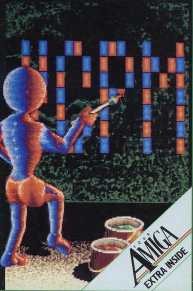

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In Australia contact: Micro Accessories of S.A., Unit 8, Hewittson Rd, Elizabeth West, S. Australia 5113 Tel: (08) 287-0191

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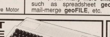

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Why put up with an old fashioned looking computer? Fit one of these smart and modern looking new cases to your trusty '64, and it will look and feel like you are using a brand new computer. This high quality injection moulded case is simple to fit and gives a lower keyboard height. Don't put up with the old image, order one *now*.

IconTroller Only £11.95

By Suncom, the keyboard mounted cursor controller, a natty little stick that attaches to your Commodore keyboard. Ideal for Icon-driven software, and perfect for GEOS applications.

LC-10 from star

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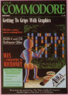
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ABC

UTILITIES

	C64	C16	C128	+4
Designer	●		●	
Character Grabber	●		●	
Adventure Kit V	●		●	
C128 FKeys Swapper			●	
Screendraw 64	●		●	

INSIDE YOUR AMIGA

FEATURES

REGULARS

VOLUME 4
NUMBER 8

ARGUS
PRESS
GROUP

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DATA STATEMENTS

£30,000 Yeti Bet

Yeti is the first release from Destiny Software and to celebrate the fact Destiny boss Francis Lee has announced a competition in which the winner may or may not win £30,000!

The reason for the uncertainty is that the whole proceeds of the competition depends on the outcome of a £200 wager which Lee has placed with hookmakers, William Hill. Success is linked with the destiny of Chris Bonnington's expedition to collect positive proof of the Yeti's existence.

Bonnington is famous for his mountaineering exploits and this latest venture follows in the wake of reported close encounters by a recent Russian expedition. Bonnington is totally convinced that the outcome of his search will result in the first film of this elusive creature, "I am convinced the Yeti does exist and is not some kind of large primate but a completely new species."

Trekker Francis Lee mounts yeti-nother £30,000 competition for his new company

Like the Loch Ness monster, the Yeti or Abominable Snowman, has been the subject of stories and myths for centuries. Sightings have been reported and footprints photographed but still any incontrovertible proof has eluded the creatures persuers. At the moment of placing the bet, William Hill was still offering odds of 150-1 against success.

The £30,000 can be yours by submitting a postcard describing the Yeti in 50 words or less to the address below. The winner will be the person who is judged to have encapsulated the true nature of the Yeti. Employees of Destiny Software or Solution Public Relations are not allowed to enter, the judge's decision will be final and no correspondence will be entered into. Remember to include your name and address on the postcard.

Lee has his own feelings about the Yeti, "The idea of the Yeti represents beauty, mystery and romance together with that hint of danger... if it is found then I hope that, once filmed for the rest of the world to see, it is allowed to remain free as nature intended."

Unfortunately, Destiny's Yeti is not 'free as nature intended', the C64 version costs £9.95.

Touchline
Destiny Software: *Lamerton House, 23 High Street, Easling, London W5 5DF.* ***Tel:*** *01-567 6677.*

Dataphone's Designer Modem

Designer Mode(m)s

A smart new modem based on the Demon II but with many additional features is on offer from Dataphone for less than £100.

Like the Demon II, the Designer has full BABT approval, full computer control, auto-dial and auto-answer. Signal handling encompasses 1200/75 and 300/700 baud rates as well as 1200/1200 half duplex for bulk uploading with automatic baud rate sensing.

The additional features of the Designer include over-ride buttons for use with manual software, a call progress monitor which allows users to hear what's happening on the line, and a parellel connector for the telephone. The modem is linked to the computer by a standard 25 pin RS232 D socket and employs a three wire telephone circuit which prevents the tinkling of extensions when the modem is in use.

Pricing details are available from Dataphone.

Touchline:
Dataphone Ltd: *22 Alfric Square, Woodston, Peterborough PE2 0JP.*
Tel: *0733 230240*

MIDI Modules

At the recent Frankfurt 88 computer exhibition, Cheetah Marketing revealed their new velocity sensitive Midi Master keyboard MLK7VA. The keyboard features a full size, seven octave console with velocity sensitive polyphonic keys with aftertouch and weighting.

Inside there is a powerful computer suitable for a wide range of uses when connected to other MIDI equipment. Despite its professional specification the cost is only £399.95.

Also at the show, visitors could see the new MD8 which Cheetah are claiming to be 'the lowest cost MIDI Digital Drum Machine on the market' at £149.95. The MD8 Machine stores up to eight true digital voices sampled at 32kHz. Further voices can be bought from Cheetah to create your own customised kit. To accompany the MD8, there is also the DPS Electronic Drum Kit and Pad Interface.

Touchline:
Cheetah Marketing Ltd: *Norbury House, Norbury Road, Fairwater, Cardiff CF5 3AS.* ***Tel:*** *0222 555525.*

Logotron At Last

Logotron is ready to release its low cost business packages for the C64 through its new division, Logotron Business Products. The first three programs form their new 1925 Series whose name is derived from the £12.95 price tag, though a three-in-one version is available for £29.95.

Writer 1295 is a wordprocessor with full editing facilities for creating personalised correspondence, reports and documentation. It supports special printer functions such as bold and underline facilities, performs cut and paste either within a document or from one document to another, employs auto page numbering and page formatting. The amazing spellchecker boasts 100,000 commonly used words with rapid execution.

Filer 1295 forms a database which can handle up to 10,000 records with up to 25 characters in each field. Its search and select functions can pinpoint and guide the user to any particular field within an individual entry.

Planner 1295 comprises of a spreadsheet with extensive arithmetic functions which calculates to a precision of 12 digits. Rows and columns can be copied, inserted and deleted at will.

All three programs will communicate with one another for mail merge purposes and further details are available from Logotron.

Touchline:

Logotron Ltd: *Dales Brewery, Gwydir Street, Cambridge CB1 2LJ.* ***Tel:*** *0223 323656.*

Flame Protected

Computer owners worried about a computer system inferno will be heartened to learn that Fire and Safety Training Ltd are to hold a seminar dealing with fire protection of computer installations.

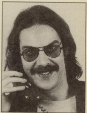
The one day course on July 17th 1988 will be held at the Cranfield Institute of Technology, Cranfield, Bedford MK43 0AL, from where further details and booking forms are available. The seminar costs £120 including lunch and refreshments, so book now to avoid disappointment.

Poached Egghead

Micro-musician Rob Hubbard has set his sights on the Sunshine State of California. After working with Electronic Arts at its San Mateo headquarters last summer, negotiations to tempt him onto its permanent staff were successfully concluded recently. The stunning music for Skate or Die was the first fruit of this liaison and Hubbard is now hard at work completing several other projects for EA.

During an incredibly successful four years as a freelance programmer, Hubbard has produced music tracks for over 60 games including Sanxion, Monty on the Run, Crazy Comets and Knucklebusters. Despite offers from several British software houses, he has jealously guarded his freelance status and Electronic Arts' offer must be considerable though no figure has been revealed.

In a fit of PR fervour, Hubbard is reported to have said, "My time at Electronic Arts convinced me that this was the right company for me to join. It could provide me with necessary support, both technically and technologically, to develop my skills as a music artist to their full potential." Funny, he didn't say anything about money!



Rob Hubbard makes a last phonecall as he defects to the West (Coast)

Touchline:
Electronic Arts: *Langley Business Centre: 11-49 Station Road, Langley, Slough, Berkshire SL3 8YN.* ***Tel:*** *0753 49442.*

RAM Stick

RAM Electronics have released a new joystick which they claim exhibits high precision at a low price. The triangular base which allows hand held or table use gives rise to its name – the Delta. They further back their confidence in the Delta by offering a two year guarantee.

Six high-quality micro-switches form the direction sensors and fire buttons with autofire capability. The base has sucker feet to allow a firm anchorage for the stick and its large handle gives the user something to really come to grips with.

All this can be yours for £9.99 inclusive of VAT.

Touchline:
RAM Electronics (Fleet) Ltd: *Unit 16, Redfields Industrial Park, Redfield Lane, Church Crookham, Aldershot, Hampshire GU13 ORE.* ***Tel:*** *0252 850085.*

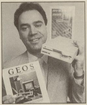
DATA STATEMENTS

Disk Dive

Evesham Micros has announced a £30 reduction in the cost of its Excellerator Plus disk drive package. Now costing £129.95, the package includes the fully compatible drive plus GEOS (Graphic Environment £20 will also add the Freeze Machine cartridge to the package.

The popularity of the Excellerator coupled with the weakness of the US dollar has resulted in this special offer which further enhances the drive as an alternative to Commodore's own 1541. Before the cut, the recommended retail price of the Commodore drive was still £30 higher than Excellerator even ignoring the GEOS software.

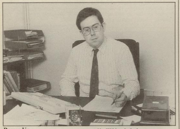
We are still awaiting the results of Evesham Micros challenge to find software that is incompatible with their latest Excellerator. Will anyone win an Amiga?



Managing Director, Richard Austin, fully supports his company's latest price cut

Touchline:

***Evesham Micros:** 63 Bridge Street, Evesham, Worcestershire WR11 4SF.*
***Tel:** 0386 765500.*



Power Up

Ashley Hildebrandt, the dynamo behind The Power House

The Power House is being relaunched as an independent company after its recent acquisition from CRL for a rumoured sum of £20,000. The aim is to increase its profile and to this end Michael Baxter's Solution company has been appointed to handle all public relation matters and USD will take care of sales and merchandising.

Baxter was appointed on the strength of his company's previous experience in handling PR for Code Masters budget software and USD have a much respected performance in their field of marketing.

In the wake of these latest moves, Managing Director Ashley Hildebrandt commented, "We are sure that with Solution handling our PR and USD our sales and merchandising, our marketing in these areas will be faultless." A nation holds its breath.

Touchline:

***The Power House:** Powerhouse Publishing Ltd, 204, Worple Road, London SW20 8PN. **Tel:** 01-947 2439.*

Disco Tech

Micronet, part of British Telecom's Prestel network, has launched its own on-line music magazine, Music City. Computer users will be able to log onto the system and download music software into their own machines as well as receiving pages of music news and views.

Micronet's operators, Telemap Ltd, have covered the thorny problem of copyright in an agreement with the Mechanical Copyright Protection Society (MCPS) whereby royalty payments will be paid for copyrighted material appearing on Music city.

Apart from an extensive range of music, the magazine will also cover the latest developments in computer music.

Phil Godsell, Micronet's Software manager, says of this system, "What we are doing is exploiting the medium (Viewdata) to its best advantage. Other magazines can feature computer music but how many of them can feature computer music (software) that can be played there and then?" Obviously, he hasn't been buying Commodore disk User with its free disk available now from your local newsagent now!

Touchline:

***Micronet:** Telemap Ltd, Durrant House, 8 Herbal Hill, London EC1R 5EJ. **Tel:** 01-278 3143.*

On-line Lifeline

Following our review of York Electronic Research's RS-232 Interface, several customers have requested the addition of Prestel/Viewdata software support. This has resulted in the production of a terminal emulator for operation with a 1200/75 baud modem.

The program can display the full range of mosaic graphics, normal and double-height symbols, hidden/revealed text with steady and flashing-mode characters in all seven colours. The terminal is capable for accessing Prestel, Micronet and CityService information systems and the full keyboard can be used for uploading data over the reverse channel.

The price is £22.99 or £14.99 for existing owners of the YER Interface.

Touchline:

***York Electronic Research:** The Fishergate Centre, 4 Fishergate, York YO1 4AB. **Tel:** 0904 610722.*

Designer

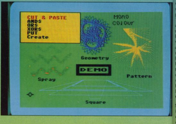
A powerful drawing package for C64 owners

By Paul Gilfoux

Designer is a graphics package that offers features normally found on expensive commercial packages. As with those packages, this program has facilities for:
cutting and pasting;
saving and loading;
geometry;
rotating;
enlarging plus much more.

Before we go into depth about the program itself it is important that we understand how graphics on the C64 work, specifically in hi-res mode. Hopefully you will have read about high-res plotting in your manual and you will know all about it. It is important that you should also know about multi and mono colour modes as Designer allows you to use both of these.

Basically you must treat the screen as 1000 individual characters. Each character can have its own background and foreground colour, or if you are using multi-colour, each character can have three colours. A moveable window is used within this program to carry out many of the functions. The window is extremely important and will be discussed later.



Getting Started

Once the program is started it will be in mono-colour mode. A joystick in port 2 will allow you to move the cursor around the screen. The fire button on the joystick must be pressed and the joystick moved up in order to start drawing. To stop drawing you must press the fire button and move the joystick down.

Modes

There are five plotting modes available in Designer. These modes not only affect the way in which the joystick plots, but every function that involves any type of drawing. Keys 1 to 5 are used to select the mode. The mode will also be affected by the type of screen you are using.

Mode	Multi	Mono
1	Colour 0	Background
2	Colour 1	Background
2	Colour 2	Foreground
4	Colour 3	Foreground
5	Test	Test

If you are drawing in multi-colour mode, mode 1 will give you the colour of the screen. If you have plotted any lines in other modes, mode 1 will erase them when you go over them again. The same is true in mono-colour for mode 2, as well as mode 1. You will see what I mean if you press '3' and draw a line. Now change to mode 1 by pressing '1' and go over the line again. You will not be surprised to know that modes are the most important aspect of Designer and you will use them frequently.

Designer is a menu driven program. To acess the menu you must press the space bar. Cursor down allows you to select the option that you require from the menu. use the RETURN key to activate your choice.

Press RETURN again to exit from a sub-menu or function.

Four main menus exist in Designer and these give access to 15 sub-menus. On each menu the word 'MORE' appears at the bottom. Choosing this moves you onto the next menu. When you wish to return to the normal screen you should move the menu highlighter, with cursor down, until no options are highlighted and press RETURN.

Another important feature of Designer is the window. If you select 'window' on menu 3 you will see the current window whenever you press a key. Use the cursor keys to alter the size of the window and the function keys to move the window around. The window can be any size from one character to the size of the screen.

The idea behind the window is that any colours you want can be implanted in screen, within the dimensions of the window. Some packages take the burden out of this by a process of ANDing and ORing and ROLLing. This program uses other methods to perform this as you will see later.

The window can be used for scrolling, transforming, colouring and clearing. I will cover all of these later. For now we will work our way through the menus. Figure 1 gives details of the menus and the options on them.

I will take each menu in turn and look at the functions available:

MENU 1

TRANSFORM (A)

MIRROR: Will mirror any pixel data or drawing in the window.

SPIN: Will spin any pixel data in the window by 90 degrees. The spun image will be transferred to the top left hand part of the screen, under the menu. This is only really effective in mono colour but in some cases can be used in multi-colour as well.

FLIP: Flips over any pixel data in the window. If you are using more than 3 colours in the window, their positions may become confused and you will have to re-define them.

EXPAND X: Expands any pixel data in the window, horizontally. The window must start at the top left part of the screen. Window size determines function.

EXPAND Y: As above but vertically.

GEOMETRY (B)

SHAPES: You will be required to input six numbers for the program to draw the shape. The cursor will be central to whatever shape you describe – so if the cursor is in the centre of the screen, so will your shape. The first two inputs "col and row' are for the size of the shape. When you are asked for the shape you must enter how many sides you want it to have 0-2 will give a circle, whereas 3 gives a triangle. The fourth input is the angle of the shape. The fifth input is for use with the REPEAT function. The number to enter for this should generally be between 5 and 30 for the best effects. When you are asked for a number for FILL, you would normally enter 2 or 3, or in some cases when using MULTI, enter the number corresponding to the colour the shape was drawn in. This number will be used later with the FILL function.

REPEAT: The number specified previously for increment is used here to re-draw the shape at a new angle. The new angle is found by adding the increment to the angle of the drawing.

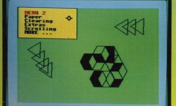
SQUARE: By selecting this you will either turn it on or off. When it is on you will be putting down markers to produce a square exactly the size you require. You can also create more complex shapes by arranging the markers in different ways. Before you can really get to grips with this function you will have to learn about markers.

There is a function within the program that will allow you to place markers at the cursor position. This is useful for remembering where lines end or start. However, there are two further uses for markers. One is the SQUARE and the other FUNCTION.

To obtain a square, you must place the markers from left to right/down. The four markers will be placed automatically and the square will be drawn. The first figure shows this.

Should you wish to set up more complex shapes you should retrieve two markers and place a marker at a different position. Look at picture 2.

This process can be repeated in different ways to set up more complex figures. You can place these markers at the top as well as the bottom. You should experiment with markers to see the effects for yourself. When you are ready you should turn the square function off and clear the markers.



COLOURS (C)

SETCOLOURS: You are asked to input three numbers for colours, they are as follows:

BLACK	0	ORANGE	8
WHITE	1	BROWN	9
RED	2	Lt RED	10
CYAN	3	GREY-1	11
PURPLE	4	GREY-2	12
GREEN	5	LtGREEN	13
BLUE	6	Lt BLUE	14
YELLOW	2	GREY-3	15

When you have done this the program will remember the colours, it is up to you to implant them in the screen.

It is worth mentioning at this point that when you clear the screen, the three colours that have been selected will be implanted in it.

GET COLOURS: From the point where the window originates the screen colours will be fetched and remembered. Useful if you leave a drawing and forget what colours were used.

SET WINDOW: This will implant the selected colours within the window only.

RANDOM: Will set the whole screen to random colours.

CUT AND PASTE (D)

AND$: You will be required to input a number for the sprite that you wish to and with the present screen data. The operation will occur at the window origin.

OR$: As above except that the operation will be OR.

XOR$: As above but the operation will be an exclusive OR.

PUT: As above but the sprite will be placed on the screen in the normal way.

CREATE: The program incorporates for saving and loading pictures from tape or disk. In order to be able to do this you must assign your picture a number – then it will be known as a sprite. To create a sprite you must have your drawing inside the window and must start at the top left part of the screen for your picture to be 'photographed' by DESIGNER properly. The actual window size must be the same or larger than your drawing. You can assign a number to a sprite the size of a character or the entire screen. Should you reassign a sprite, its previous image will be lost.

You will normally want to set individual sprites for animation which is also catered for in this program. Because this process uses up large amounts of memory do not expect to be able to have much more than a whole screens worth of drawing stored at any one time.

MENU 2

CURSOR: Changes the cursor colour.

MARKER: Changes the marker colour.

PAPER E: Changes the paper colour only when using MULTI. In MONO-colour the colour of the screen is determined by the background colour chosen.

BORDER: Changes the colour.

CLEARING (F)

CLR SCREEN

CLR WINDOW As its name implies, this function clears only pixel data selected by the window.

CLR MARKER: When selected, any markers on the screen will be cleared. The can of course be used again.

EXTRAS (G)

STARS: Plots random stars on the screen in different modes

GRID: One problem in using a joystick to draw is that it is not always very accurate. This feature allows you to control your drawings to the single pixel.

When you select this function a grid will be drawn in place of the menu. The grid corresponds to a single character block. While you are using this function you will have access to move the window, change modes and draw with the joystick.

To see how this function works you should use the function keys to move the window well clear of the grid. When you are clear of the grid, move the cursor onto the grid and carefully position onto any square you wish.

If you want to fill any square you should press F, but it is important that you should keep within the confines of the grid. Also, you shouldn't change modes as this could end in disaster. If you attempt to fill any shape at any time and there is a gap in between the lines or line the filling will leak, probably all over the screen. I will explain more about this later.

When you have defined the grid the way that you require press (P) to place it on the screen at the window position. The window should be the size of one character to avoid any mistakes.

Should you wish to edit the data in the grid you should press (E) and guide the cursor over the squares that you don't want, then press (F) to fill them. They will then disappear. When you are satisfied (D) to re-draw the grid, then press (P) to put it on the screen again. Clear the grid by pressing (C).

Should you wish to examine any pixel data, simply position the window over the character block, and press (G) for Get. This function should mainly be used in MONO colour. It can be used in MULTI colour but you should only use mode 2. When you select the grid function the appropriate mode will be selected to avoid any errors.

It is worth pointing out that if modes are used incorrectly the function for filling will usually spill.

You will not be able to edit in MULTI colour, but this can be achieved by returning to MONO. After editing in MONO you can return to MULTI. One other point worth mentioning about MULTI colour is that you should treat two pixels as one pixel. Thus, when filling in a square you should also colour the adjoining square.

CHANGE CRSR: If you are not happy with the cursor you can define it for yourself. To do this you must have the new cursor drawing at the top left side of the screen. It must be three character blocks wide and three deep – the normal dimensions for a hardware sprite.

It is generally best to define the new cursor in multi-colour mode. The markers will also take on the new appearance. An important feature about the menu box, is that any pixel datas you place under it will remain there when the box goes.

SCROLLING (H)

PIXELS: When this is selected, you should enter the direction of the scroll. The actual scrolling will be taking place in the window only.

COLOURS: The same as above except only the colours are scrolled.

ANIMATION: You should store a sequence of sprites – say from 1 to 10, to be used by this option. How many you use is up to you. Enter the number of the first sprite and then the number of the last sprite. When you have entered the time delay, the sequence will be animated.

MENU 3

PLOT/SPLIT (I)

SPLIT: This is a function that when turned on, will produce a second plotting line parallel to the first. The space between these lines is known as the SPLIT, and it can be set between 0 and 9.

Try drawing some boxes and use a marker to close the lines properly, and you will see that the effect is a professional looking window.

INC SPLIT: This will alter the space between the lines.

INC PLOT: To achieve dotted lines, you would ideally have the split turned off. If you use INC PLOT now, you will be able to set a space of between 1 and 9 for plotting, and so get a dashed line.

PATTERN (J)

PATTERN: When this function is turned on you will be able to draw more fringes in any part of the screen. In order to do this you will also have to alter INC PLOT, but remember it will not be necessary to do any plotting in the normal way. You will see later that this function should be used in conjunction with other options.

NEW ORIGIN: When drawing moire fringes with the PATTERN function you can control its origin on the screen by selecting this command.

PUT MARKER: I have already spoken about markers and this is the function that allows you to place them. There are only four markers available for use. Should you have four markers placed and you try to place another marker, the first marker down will be lost.

GET MARKER: When selected, the last marker you put down will be retrieved. You can retrieve all 4 should you require.

SPRAY (K)

SPRAY: This will produce a spray effect by setting random pixels in a small radius. The thickness of the spray can be altered but as the thickness increases the speed of the cursor will become slower. There are other functions that can be used in conjunction with spray to make it more powerful but more about that later.

THICKNESS: This allow you to set the thickness of the spray.

SYSTEM RESET: Will RUN the whole program from the beginning but leave any sprites that you have created in memory.

WINDOW (L)

When this is selected you will have immediate access to shape and move the window. Use the CRSR keys to alter the size of the window and the function keys to move the window around.

MENU 4

MIXED MODE (M)

DRAW: This function operates directly with the first marker. The idea being that when the first marker is placed on the screen, a line will be drawn from the cursor to the marker.

MIX MODE: When you turn this on the effect will only be appreciated in MULTI colour. By using this function, colours 1, 2 and 3 will be used at random. This is achieved by switching between modes. If this is used in conjunction with 'PATTERN', you will see the effect will be quite amazing. This is particularly useful for the 'SPRAY' command.

If you have set some interesting colours, by using MIX MODE you can create colour hues, and it may well appear that you have more than 16 colours. It is important that you should NEVER 'FILL' any object when MIX MODE is ON. Always remember to turn it off when you have finished using it, and remember that the actual mode will probably be different from the one selected on entry to this command.

CURSOR(N)

CENTER: This simply places the cursor in the centre of the screen.

HOME: The cursor will be moved to the top left section of the screen.

OLD CRSR: If you have redefined the cursor to your own design this routine will return you to the original cursor.

SLOW: So far, if you have done any plotting with the joystick, you have only used one speed. This function slows the cursor down until you either look at the window or access it. The only drawback with this function is that it will slow the entire DESIGNER program down. Press the left arrow key to view the window and normal cursor and program speed will be restored.

PRIORITY: When this is OFF, the cursor will appear in front of any screen data. If the priority is ON the certain lines in your drawing will appear in front of the cursor.

SAVE/SCREEN (O)

MULTI-SCREEN: This turns on MULTI-COLOUR MODE.

MONO-SCREEN: This selects MONO mode.

SAVE: You will be asked for a file name – the maximum number of characters is ten. When you have entered the filename you will be asked if you want tape or disk. When you press the relevant key your sprites will be saved. Should you decide that you do not want to continue with the operation then you must enter 'RETURN' as the file name, and you will return to the sub-menu.

LOAD: Same as above except that the operation is for loading sprites.

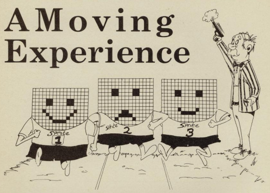
TEXT/FILL (P)

TEXT: There are four character sets available. Sets 1 and 2 will give you normal size characters. Sets 3 and 4 give you double size characters. While you are using this function you will be able to control the window with the function keys.

The text characters will be put on the screen at the origin of the window, so it is best if you keep the window size to 1 character block. When you are ready to start putting your characters on the screen use keys (+0 and (-) to go through the character set.

See listings on page 98

A Moving Experience



If sprites move you to tears, here's all the info to move them instead!

By Eric Doyle

One of the problems with the C64 is that it has no commands for controlling the sprites which are such essential elements for all kinds of programming applications.

Sprites are also known as MOBs which stands for moveable object blocks. They are like tiny screens which can be moved across, independently of the main screen and each other. Sprites are square but they seem to assume all manner of shapes on the screen by rendering peripheral areas as transparent. Anything behind a sprite is visible in these areas allowing the sprite to blend in with the background.

Each sprite definition occupies a 64 byte block of memory within the 16Kb area which the video chip, VIC, can access. This gives a potential of 255 definitions but only eight sprites can be displayed on the screen at a time. Exceed this value and some sprites will disappear or start to flicker.

Located just after the screen memory are eight locations called sprite pointers which indicate the 64 byte block which holds a sprite and allocates a program number to the sprite.

The sprite definitions are known as Sprite Data 0 to Sprite Data 255 but the program calls the eight selected sprites Sprite 0 to Sprite 8. This may sound confusing but all will become clear.

A problem for the beginner is that sprites make heavy use of two of the least understood commands in the Basic language – PEEK and POKE.

I remember approaching these commands with great trepidation during my VIC 20 days but let me assure you that they aren't as fearsome as you may at first think. Imagine a computer as a row of glass boxes numbered from 0 to 65535. Each box contains a volatile number which has a value of 255 or less. PEEK allows you to look through one of these boxes to see what number lies there. It then reports back what is has found but doesn't leave the contents of the box untouched.

POKE actually opens the box, the number vanishes into the ether and is replaced with a value that POKE has been given to store away. This value may be derived from the original value inside the box so PEEK and POKE are dispatched together to complete the mission. For example, POKE 53248, PEEK (53248)+1 would result in PEEK reading the value through the side of the glass box numbered 53248. This value would then have one added to it and be passed to POKE. The box would be opened and the contained number would disappear before the new number was inserted.

These commands form the basis of sprite control but with eight sprites to worry about we'll just consider one for now and get complicated later.

The first task is to organise the memory of the C64 to accommodate the sprites.

Setting Up

The most arduous tasks in sprite manipulation are the setting up procedures. First you have to decide where the sprites are going to be stored, then you have to design them in multicolour or standard format. After this the sprite pointers and parameters have to be set and only then can you really do anything with them.

Sprites have to be in the same bank of memory as the screen and any user-defined character sets which may be required. This has to be crammed into a mere 16Kb chunk. The most constructed bank of memory is the one which is called the default setting and therefore is used when the computer is first set up. In this area virtually all of the first kilobyte (1024 bytes) is memory dedicated to keeping the Basic operating system operating. Then the next kilobyte is used by the screen. After that comes a free 14Kb of memory which must be shared by the program, character set and sprite definitions.

Not much room so let's change the memory around a little. The start of Basic is stored in locations 43 and 44 which are set at 01 and 08 respectively. If this can be moved to the start of Bank 1 of memory (16384) a whole 14 Kb will be available for sprites, screens and characters. The Basic Mover listing will achieve this for you. When creating your program substitute a nonsense filename as string A$. Once you have a program to load substitute its name in A$ and make another copy of this amended program as your loader routine.

Available sprites are now 13,14 and 15 in the cassette buffer with sprites 32 to 255 available in normal Basic area which is now effectively protected from the new Basic start.

Sprite Preparation

The program called Sprite will set up a sprite for you to play with as Sprite Data 13.

The computer needs to know where this sprite is so we turn to the sprite pointers which occupy eight bytes from location 2040. We'll allocate our sprite definition to the pointer for Sprite 1 by poking the value 13 to the second pointer (POKE 2041, 13).

Next a colour has to be applied to the sprite. Each sprite has a register in the VIC chip for its own colour. These lie from 53287 to 53294. Our sprite is dark blue so the next command is POKE 53288, 6. Still the sprite remains invisible. The on/off switch is located in the byte at 53269. To turn the sprite on we have to flick the second bit on by giving it a value. The easiest way to do this is to poke the location with 2 but the best way is to modify the value which is in there already. This is best because you'll reach a situation one day where you can't be sure which sprites are on or off, all you know for sure is that Sprite 1 should be turned on. We need a command which will set bit 1 but leave the other bits unaffected. Boolean algebra supplies us with a way to do this.

The OR command dictates that when two bytes are ORed together each corresponding bit in the two bytes are compared with one another, if either or both are set to one the resultant bit value is a 1. What happens if 164 is ORed with 2?

```
164 10100100
  2 00000010
166 10100110
```

Bit 1 is set by this method and the other bits maintain their states. What's more if the two bit was already set it would also remain set. This means that a suitable equation for switching on a sprite would be:

```
POKE 53269, PEEK (53269) OR
(2 ^sn)
```

Where sn is a sprite number from 0 to 7. For our sprite, 1 will be substituted for sn. This type of equation is used a lot in sprite manipulations so we'll call it the switch command. The unswitch command which can turn any one sprite off looks like this:

```
POKE 53269, PEEK (53269) AND
(255-2 ^sn)
```

After turning the sprite on it may still be invisible. This is because its parked somewhere off the visible screen. POKE locations 53250 and 53251 with 100 and it should appear.

Adding Colour

What we have done is to move the sprite to a position which has X and Y co-ordinates of 100 (written 100,100 in X,Y format). Location 53250 controls the X value, Y being the preserve of 53251. All of the sprites have X/Y registers in similar consecutive pairs between 53248 and 53263.

The sprite looks a little strange because it was defined as a multicolour character to switch from standard mode, there is another location which acts like a multiway switch. Use the switch command substituting 53276 for both mentions of 53269.

The sprite looks better but it was intended that the colours would be light blue, dark blue and black. We have already seen how dark blue can be assigned but what about the other colours?

In multicolour sprite mode all of the sprites on the screen have the same secondary colours because they are obtained from a common pair of memory locations, Multicolour 0 from 53285 (allocated to 01 bit pairs in the sprite) and Multicolour 1 from 53286 (allocated to 11 bit pairs). 53285 is to be assigned as black so it should be poked with a zero. 53286 is light blue and needs to contain a value of 14. Note that the main colour, the light blue stored in the sprite colour register, is given to all bit pairs configured as binary 10 which differs from the equivalent situation in Multicolour UDGs where the main colour is designated to a 11 bit pair. A sprite 00 pairing is transparent and shows anything lying beneath it.

Sprites can be magnified vertically and horizontally. Type in the following commands and see what happens:

```
POKE 53277,2
POKE 53271,2
POKE 53271,0
POKE 53277,0
```

Within a program, the correct way to do this would be to use the switch and unswitch command types but for this simple demo we'll waive this convention.

Over and Under

In normal use sprites can pass over, or behind, the background and may even move across one another. For sprites passing one another there is a fixed priority. Sprite 0 will always pass in front of all other sprites, Sprite 1 will pass behind Sprite 0 but in front of all the others, and so on down to poor old

Sprite 7 which always passes behind another sprite. It follows that sprite priority should be considered when deciding which sprite's data each sprite pointer indicates.

Background characters such as the standard ROM characters or UDGs can be given priority over any sprite by a register at 53275. If the bit controlling any particular sprite is set, the sprite will pass behind any screen characters. To see this in operation, move the cursor to the sprites current position and type a few characters. These will be hidden by the solid part of the sprite. Next, move the cursor to an empty lie beginning and type POKE 53275,2 and the sprite will 'sink' into the background behind the typed characters. Many 3D effects can be created using sprite to sprite and sprite to background priorities.

When two sprites collide the event is registered at location 53278. Each sprite has its own bit and both colliding sprites are registered. This means that a collision between Sprite 0 and Sprite 1 will return a PEEKed value of three (bits 0 and 1).

Similarly, sprite to character collisions are registered in 53279. PEEKing normally has no effect on a memory location but in both these registers the act of PEEKing causes the register to be cleared. If a collision has occurred some time ago and the Sprites 0 and 1 are no longer in contact, the first reading of register 53278 will return a value of three but a second PEEK will result in a zero (unless two other sprites are in collision).

A collision is only registered when an area of the sprite which has a bit pairing of 11 or 10 is touched. Transparent 00 pairs and Multicolour 0 areas both have no effect. This makes it possible to have an area of the sprite which is coloured but does not register a collision.

Getting About

Sprites can be moved a pixel at a time much more easily than UDGs because of their dedicated X/Y registers. For Sprite 1 these registers are 53250 and 53251. Sprite movement is achieved by increasing or decreasing the values contained in these registers. Changing only one of the registers causes movement in the plane that it controls, up or down. If both registers are changed the perceived movement is diagonal.

When the value of the Y register reaches a value less than 50 or greater than 250, the sprite starts to disappear behind the border, row by row. The same thing happens if the X register falls below 24. This means that sprites can gently glide off the screen and hide behind the border. At power up, all of the sprites are stored out of sight at 0,0. In this position they are all touching and if they were turned on, the collision detector would register a maximum 255. It must always be remembered that sprite collisions can occur of the screen as well as on.

When discussing the visible limits of the X register no mention was made of the maximum value. This is because, although there are 255 pixel positions, the horizontal resolution allows 512 pixel positions. One byte can only store a maximum value of 255 so a special register is allocated to store an extra ninth bit. Only one bit is needed to extend the maximum nine bit byte value of 511. The ninth bits for all of the sprites are stored in 53264. Each high bit is allocated to a bit in this location so setting the high bit uses the switch command format.

The procedure starts when the current X value is known to be, or PEEKed and found to be 255. This register must immediately be poked back to zero and the high bit in 53268 must be set. The X register can then be increased again until it reaches 89 or more when it starts to glide behind the screen and under the border. Once the sprite has completely disappeared the high byte could be cleared using the unswitch command format.

The best way to master sprite control is to jump in and try it. To help you in your plunge Table 1 includes all of the major sprite locations.

TABLE 1

Sprite 0		
X co-ordinate		53248
Y co-ordinate		53249
Colour Register		53287
Pointer	Screen start	+1016

Sprite 1		
X co-ordinate		53250
Y co-ordinate		53251
Colour Register		53288
Pointer	Screen start	+1017

Sprite 2		
X co-ordinate		53252
Y co-ordinate		53253
Colour Register		53289
Pointer	Screen start	+1018

Sprite 3		
X co-ordinate		53254
Y co-ordinate		53255
Colour Register		53290
Pointer	Screen start	+1019

Sprite 4		
X co-ordinate		53256
Y co-ordinate		53257
Colour Register		53291
Pointer	Screen start	+1020

Sprite 5		
X co-ordinate		53258
Y co-ordinate		53259
Colour Register		53292
Pointer	Screen start	+1021

Sprite 6		
X co-ordinate		53260
Y co-ordinate		53261
Colour Register		53293
Pointer	Screen start	+1022

Sprite 7		
X co-ordinate		53262
Y co-ordinate		53263
Colour Register		53294
Pointer	Screen start	+1023

Bit Registers								
bit	7	6	5	4	3	2	1	0
value	128	64	32	16	8	4	2	1
sprite	7	6	5	4	3	2	1	0

on/off switch	53269
Multicolour switch	53276
X co-ordinate bit 9	53264
Increase height	53271
Increase width	53277
Character priority	53275
Sprite collisions	53278
Character collisions	53279

Colour controls	Bit Pattern	Location
Colour register	10	53287 – 53294
Multicolour 0	01	53285
Multicolour 1	11	53286
Transparent		
Border colour		53280
Screen		53281

Sprite co-ordinate ranges

Screen dimensions	Total	Visible
40 characters (X)	0 - X+87*	24 - X+87*
38 characters (X)	0 - X+87*	32 - X+79*
25 characters (Y)	0 - 255	50 - 249
24 characters (Y)	0 - 255	54 - 245

* Set the ninth bit register after 255

See listing on page 100

53254
53255
53290
+1019

53256
53257
53291
+1020

53258
53259
53292
+1021

53260
53261
53293
+1022

53262
53263
53294
+1023

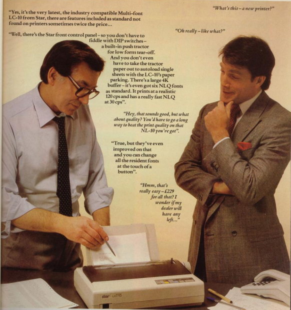
0
1
0
53269
53276
53264
53271
53277
53275
53278
53279

ocation
3287 –
53294
53285
53286

53280
53281

Visible
- X+87*
- X+79*
50 - 249
54 - 245
er 255

"£229 for all that?"



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"What's this – a new printer?"

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"Oh really – like what?"

"Hey, that sounds good, but what about quality? You'd have to go a long way to beat the print quality on that NL-10 you've got".

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LCYC5

GAMES UPDATE

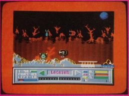
This month's releases are dominated by budget games with Mastertronic, Code Masters and Firebird battling for the top spot. Newcastle based Zeppelin games is the latest into the fray and launched its first two games. Read on for details of these and news of the Alternative World Games and the next in the long running Leader Board saga

By Tony Hetherington

Full Priced Games

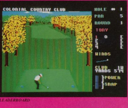
ALTERNATIVE WORLD GAMES (Gremlin Graphics) is a collection of weird and wonderful sports events that will have you in stitches as well as the canal, river and a sack. Eight events will inevitably take their toll on your joystick and your sanity as you compete against human or computer opponents in a sack race, by running while carrying as many plates as possible, throwing a boot as far as possible, leaping a river in a single bound, climb a pole, run up a wall, burst balloons with a pogo stick and defeat all comers in a pillow fight.

English Software's sequel to its popular Knight Games, KNIGHT GAMES II, takes the contestants into space for a series of shoot 'em-ups before qualifying for a head to head contest in jet jousting, light sabres and photon chains. I thought the final three events did capture the feeling of a clash between knights in the year 3032 unfortunately, you have to blast your way through countless aliens to get there!



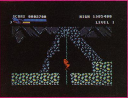
KNIGHT GAMES II

Do you remember Leader Board, the hit and hope golf game from Access that featured golf holes constructed from islands set in a vast water trap that shot straight to the top of the charts? It was followed in quick succession by Leader Board Tournament (that added new courses), Leader Board Executive (introduced trees) and World Class Leader Board (trees, bunkers, a driving range on disk versions and a top down view of each course). The bleed-an-idea-dry department has produced WORLD CLASS LEADER BOARD – FAMOUS COURSES OF THE WORLD VOLUME 1 (Access/US Gold) which means there's more to come! This latest Leader Board model is basically World Class Leader Board which includes computer versions of three of the best known golf courses and another Access created challenge course. Now your joystick controlled golfer can stroll the fairways and greens of Pebble Beach, Colonial and Muirfield and they go badly over par on the challenging course at the Glenmoor Country Club.



LEADERBOARD

RASTAN is the latest Taito coin-op conversion from Imagine in which you play the King of a hardy breed of barbarians and must defend your people from the evil



RASTAN

Wizard Karg and his evil minions that he has unleashed on the land of Maranna. Armed with your sword and an iron will you must travel through the countries of your continent until you finally face the wizard in his deadliest guise as the soul-sucking dragon. Through joystick controls you will cut and hack your way through winged men, chimeras, gigas (lizardmen), bats, fish, snakes, many armed bugs and skeletons as you fight your way through the games six levels. Along the way you can aid your quest by collecting weapons and magical items such as a shield and armour to reduce damage done to you, a ring to speed up your actions and jewel for bonus points.

Rastan is a fast, smack anything that moves game which is let down by poor animation but still worth a look by fans of the arcade machine.

PEGASUS BRIDGE is the latest in PSS's wargamers series and is based on the crucial airborne assault by the British 6th Airborne Division on key gun positions and bridges that cleared the way for the D Day landings.

This is not a task for the faint hearted as although desperately outnumbered, the British must parachute behind enemy lines and destroy major targets before taking and holding three important bridges against massive German counter attacks. If you prefer, Pegasus Bridge allows you to play the Germans in the equally difficult job of defending a wide area against an attack that could literally come from any direction or take on an opponent in a head to head battle.

CRL once again grabbed the headlines by persuading the censors to slap an 18 certificate on it's new "shock, horror" adventure based on the life and works of JACK THE RIPPER.

In the game that is built on ghoulish graphics and blood curdling text you play an innocent man who stumbles on one of the Ripper's victims, gets mistaken for the murderer by the police and in your panic to escape you slay several policemen and old ladies yourself which absurdly takes your kill total to Ripper standards in three screens of text. You then spend the rest of the game tracking down the real (other) murderer while keeping one step ahead of the police and out of jail.

Jack the Ripper falls sadly short of the standards set by CRL's other horror adventures Dracula and Frankenstein and is ruined by gory descriptions that go beyond the story line and become just silly. For example, even if you're in a blind panic, pushing an old lady doesn't cause her brains to spill out onto the pavement! Let's have less hype and more gameplay.

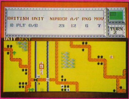
Finally, on a lighter note Cascade has released a breakout construction kit called TRAZ. This actually stands for Transformable Arcade Zone and includes a 64 screen breakout game and a construction kit to build your own screen and pack it full of bricks, traps, refractors, bumpers and monster generators.

Budget Games

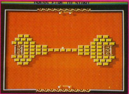
This month's big budget news is that Mastertronic has rereleased two of the best selling games of all times as part of it's £1.99 Ricochet range. GHOSTBUSTERS and WAY OF THE EXPLODING FIST both topped the charts when they were first releases by Activision and Melbourne House and are set for a successful return in their cut-price format.

Melbourne House's Judge Dredd, Knuckle Busters and Bazooka Bill also make a Ricochet comeback as does Bubble Bus's Skate Rock which plays like a cross between Skate or Die and Paperboy!

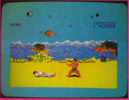
Mastertronic has tried to up the budget stakes by launching the new MAD X range of games that include two



PEGASUS BRIDGE



TRAZ



WAY OF EXPLODING FIST

GAMES UPDATE

games for £2.99. One of the first MAD X releases is ROCKFORD which is the budget home computer version of the Amiga based arcade game Rockman that was based on the First Star C64 game Boulder Dash! The gameplay is the same addictive Boulder Dash style but has some interesting added features such as growing walls, snakes that turn rocks into treasure and treasure into rocks and fire that can be put out if you can find a tap, turn it on and then push the drops of water to the fire.

ROLLAROUND is the pick of the standard Mastertronic games this month, and is an incredibly addictive mix of collecting the correct number of six different coloured crosses from Spindizzy style screens while avoiding the aliens. These aliens come in several types which will suddenly disrupt your game just when you think you've conquered a screen. There are some that will match your moves square for square, others that patrol certain areas, bombs that home in on you and particularly vicious ones that turn squares into holes.

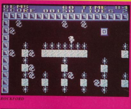
Boing! The blockbusting ball bounces back as Firebird launch 1, BALL 2 (The Quest for the Past). The highly developed and intelligent ball race want to delve into their past to discover their ancestry. However, to do this you will have to brave the radioactive dangers of the ancient mines and the perils that lurk in them and collect as many ancient artifacts as possible. Armed with a laser and the ability to bounce out (and in) of danger you must complete each mine by collecting a key, then reaching the exit before the time limit runs out.

Each mine is constructed from a series of blocks and barriers which have different properties. Some you can bounce safely on, others dissolve in time and some destroy you on contact. You will also find magic bombs that wipe out the critters that populate the mine, life particles (four make up an extra life) and gemstones that produce a random effect that can help or hinder you in your incredibly addictive quest.

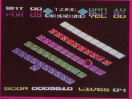
Finally, SABOTAGE and ZYBEX are the first two games from Zeppelin Games, a new North Eastern budget software house. SABOTAGE is an incredibly difficult shoot 'em-up in which you must battle across the scrolling landscape of an alien planet to find the eight pieces of a blue print to destroy it and end the occupation of Earth. This isn't going to be easy and it will take some of your six lives to get past the first wave.

ZYBEX can be played by either one or two players simultaneously that are powered by jetpacks and must battle with a bizarre selection of aliens using whatever weapons they can find. Full price action at a budget price.

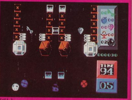
SUNBURST is the latest release from Hewson's Rack-it budget label and is written by Nebulus author John Phillips. The universe is in great danger once again, only this time it's because there are too many suns! You have been volunteered to restore the balance, by attacking these suns and destroying them by attacking energy carrying aliens that populate giant rock formations to build up enough energy to dive into the sun and turn it into a blackhole, which takes you neatly, but impossibly, onto the next level.



ROCKFORD



ROLLAROUND



BALL 2

Byting into the 6510

In this instalment of our series on programming in machine code we add a wordwrap to our typewriter program

By Burghard-Henry Lehmann

At the beginning of this series I named speed as one of the main advantages of programming in machine code. However good you are at programming in Basic, there are certain routines which execute in praxis so painfully slowly in Basic that you have to program it in machine code – or not do it at all!

In this article I'd like to continue with our simple wordprocessing program by adding a routine which proves this point once more. I'd like to add a wordwrap routine to our wordprocessor.

"Wordwrap" is one of these computer terms which hasn't been known before the advent of the wordprocessor, because you can't do it on a mechanical typewriter, nor on an electric one. The phrase means that you can enter text as if you had a never ending line to write on. When you come to the end of the actual line on the screen, you just keep on writing, never mind the end of the line, and the computer does the rest.

If you have started a new word at the end of the old line it moves – "wrappes" – the beginning of that word onto the beginning of the next line and moves the current print position automatically forward, accordingly. And it does all this while you are writing, without interrupting the flow of your typing!

The advantage of this is obvious. You don't have to wonder at the end of every line if the next word you want to type will still fit onto the old line or if you should start a new line. (As you know, mechancial typewriters try to assist you in making this decision by sounding a bell five or ten characters before the end of the line . . .)

With computers you don't have to worry about this kind of thing at all. As I've said, the computer takes care automatically of the changeover from one line to the next which allows you to concentrate completely on what you are writing. It is indeed as if you had an endlessly long line to write on.

So much about the beauty of this facility. But, as you should know by now, the computer does nothing which it hasn't been programmed to do. And in order to program such a facility, first of all we have to become very precise about what exactly we want the computer to do and when we want it to be done!

The Mechanics of Wordwrap

First the "when". From what I have explained so far, wordwrap has obviously to be done at the beginning of each new screen line. When the user types in the first character of a new line the computer has to decide if there is any wordwrap to be done and then do it.

If the user enters a space at this point, this obviously means that he has just finished a word which, as it happens, fits exactly at the end of the old line. And this means, that no wordwrap has to be done. The letters at the end of the former line are left as they are.

Furthermore, the space just entered can be ignored! Because all it signifies is, that a new word is to be started, and this new word can go flash to the left hand side, because it will be separated from the former word by the new line.

If, on the other hand, the user enters a letter, there are still two possibilities the computer has to decide on. This letter can be part of a word which has been started on the old line or it can again be the first letter of a new word, namely, if the last character on the old line had been a space.

In the first case, wordwrap is to be done, while in the latter again no action has to be taken.

Determining the Start of a New Line

The first routine you'll find in this month's listings page is to be inserted into the main routine, as given in the January issue of *Your Commodore*. It's best to place it directly after line 720, which branches to CRSR right, if that key has been pressed.

All the routine does, is look at the current print position as contained in SCREENMEM and see if it is pointing at the beginning of a screen line.

At this point I have to admit that this way of doing it is not the most efficient one in that it is rather time consuming. Normally we don't like to send the computer through a loop in the middle of a major flow, except if absolutely necessary. But since we are programming in machine code which is so quick that you won't notice the difference and since I am giving you all this only as an example to study, it works all right for our purposes.

If you are interested in wordprocessing and would like to make more out of our humble program, you might like to look for ways to do it more elegantly. One way would be by introducing extra variables which count the rows and lines and would make the determination of the beginning of a new line much more straightforward in that it doesn't require the program flow to go through the whole loop every time a key has been pressed. (This could be, at the same time, the basis for a routine which displays the line and column the cursor is on, either at the top or at the bottom of the screen...)

But in the context of this series of articles the routine numbered lines 780 – 1130 does us just as well.

It starts by saving the last keypress, which is contained in the accumulator, in a variable, called "TEMPSTORE".

Pushing this byte onto the machine stack would not be a very good idea, since we will need to recover it in the wordwrap routine itself and, if you have studied the last article thoroughly, you will know by now that you can't pull something from the stack in the midst of a subroutine which you have pushed onto the stack before you called that subroutine! (Remember my advice from the last article; if you aren't certain, better save important data in a variable than pushing it onto the stack and be sorry!)

The routine itself is very straightforward. The beginning of the second screen line (we are, of course, not interested in the beginning of the first line!) is loaded into a variable, called "LINESTART". Then it goes into a loop which compares the start of every line on screen with the contents of SCREENMEM.

If a match is found, it means that the current position is at the beginning of a new line. In this case our wordwrap routine is called in line 1050. After returning from this subroutine it continues as normal (line 1060).

If no match is found, the loop exits after 24 goes, TEMPSTORE is recovered into the accumulator and everything continues as normal.

Dealing with a Space

The wordwrap subroutine itself, which I have assembled at ORG 50100, starts off by loading the result of the last keypress back into the accumulator (line 100) and testing it for a space (lines 110 – 120).

As I have explained earlier, if the user has pressed the spacebar at this point, it means that he has just finished a word and now wants to start a new word. Therefore, no wordwrap has to be done and this space can be ignored.

In lines 140 – 150 the routine waits for the next keypress. When this keypress has been done, the result is stored in TEMPSTORE (line 170) to match it with the flow of the main routine, and then it exits prematurely from the wordwrap subroutine, continuing as normal.

If, on the other hand, a letter key has been pressed, we enter the wordwrap routine proper.

First we save the current position in the textfile, the current screen position and the current position on the colour screen in three new variables, called TEXTSAVE, SCRNSAVE and COLRSAVE (lines 260 – 390). (Remember, for those of you who still have the old ROM, we always have to deal with the position on the colour screen too!)

Doing the Wordwrap

The wordwrap routine itself consists of two parts. First we have to find the beginning of the word which the user has just started and then we have to move that part onto the new line. Furthermore, we want to substitute – "pad" – the beginning of the word on the old line with spaces so as to erase it.

The first part consists of a loop (lines 440 – 660) which works backwards, looking at each former character until it finds a space. This space signifies that the beginning of the word, the user has just started to type, has been found.

The X-register is used as a counter. Afterwards it will tell us, how many letters have to be moved onto the new line.

Notice also, that we are going back with the variables we have initiated at the beginning of the routine so as not to change the contents of our main variables, TEXTFILE, SCREENMEM and SCREENCOL! The reason for this will become clear in a minute.

Lines 610 – 630 test for the space. Once the space has been found we have to go one step forward again, because we are not interested in that space itself, but rather in the first letter of the word, which follows it. This is done in lines 700 – 800 where each position is incremented by one.

Moving the Wordstart

After this we are left with two positions in the textfile, on the screen and on the colour screen. TEXTSAVE, SCRNSAVE and COLRSAVE respectively point at the first letter of the word which has just been started, while our standard variables TEXTFILE, SCREENMEM and SCREENCOL point at the current position at the beginning of the new line.

All we have to do now is use Indirect-Y to move the data from one position to the other, while, at the same time, erasing the old position with a space.

This is done in the second loop, which I called "MOVELOOP" (lines 850 – 1020).

The Y-register is used to move the data itself from the old position to the new one and is therefore incremented with every pass through MOVELOOP.

The X-register, which holds the amount of letters to be moved, serves again as our counter and is now decremented with every pass through MOVELOOP. When X contains 0, the job is done.

Wrapping it up

Finally we have to update our standard variables (TEXTFILE, SCREENMEM and SCREENCOL) to the proper position which is now of course several rows into the new line.

I do this by transferring the contents of the Y-register, which after MOVELOOP holds the number of letters we have moved, into the accumulator and then adding that value to the respective position, that is, TEXTFILE, SCREENMEM and SCREENCOL.

"TYA" is a very simple one byte instruction which stands for "Transfer the contents of the Y-register into the Accumulator". Since this instruction doesn't change the contents of the Y-register I use it three times for all our main variables.

You might like to know that 6510 assembly language has six of these very straightforward and easy to use transfer instructions.

"TAY" transfers the contents of the accumulator into the Y-register and thus does the opposite of what we are doing in our routine.

"TAX" transfers the contents of the accumulator into the X-register. "TXA" does this same thing the other way round.

Finally, the lesser used "TXS" transfers the contents of the X-register into the stack-pointer, while "TSX" does the same thing vice versa.

Incidentally, the last two instructions constitute the only way in which you can program the stack pointer directly. In other words, if you want to program the stack pointer, you transfer its contents with TSX into the X-register, do with the value whatever you want to do and then transfer the result with TXS back into the stack pointer. But, as I've said in the last article, you should do this kind of thing only if you know exactly what you're doing!

And Finally . . .

Figure 1 gives you a list of the six assembler mnemonics we have learned about in this article.

In the next article I want to finish our wordprocessing theme by demonstrating how you can send the textfile, created by our program, to the printer and also save it onto disk or tape and load it back into the computer again.

Figure 1

TAX = Transfer contents of Accumulator into X-register
TXA = Transfer contents of X-register into Accumulator
TAY = Transfer contents of Accumulator into Y-register
TYA = Transfer contents of Y-register into Accumulator
TSX = Transfer contents of Stack pointer into X-register
TXS = Transfer contents of X-register into Stack pointer

Dan Dare II

Mekon's Revenge

In 1986, Virgin hit the top with Dan Dare and now the eagerly awaited follow-up looks set to repeat that success with avengence – Mekon's Revenge.

The Mekon has been plotting the downfall of Earth after Dan foiled his last scam which employed a deadly asteroid. Scientists have been working night and day to produce a genetically engineered race of Super Treens whose awesome powers are sure to give the Mekon total victory. Even now they are on their way…

Dan, at the head of a Space Fleet hit squad, has managed to penetrate the spaceship's defences. His mission is to seek out and destroy the Super Treens dreaming of war as they hibernate in their protective Plexiglass Life Support Bubbles (my mates at Virgin believe in safe sacks).

The ship is separated into four brilliantly coloured sections full of ordinary but deadly Treens and Space Fleet troops. The lasers blast in all directions so Dan has to duck and shoot his way through the throng, trying not to shoot his own men in the process.

Secreted around the complex are control panels which operate force-field barriers. Any intrepid adventurer would be well advised to shoot these out first because the minute a Super Treen Bubble is blasted a self-destruct mechanism clicks into action. If Dan can't destroy all of the Super Treens and get to an airlock before the countdown reaches zero, the whole section of the ship will be de-rezzed and take him on a one way trip to oblivion.

The time limit for completing the spring treening is extremely tight and only a few small errors are allowed. My best advice is to spend some time memorising and mapping the corridors, but be careful not to run out of energy. When you then blast your first Super Treen you should at least know where you ought to be going.

If Dan makes it to the connecting passage to the next level, a door closes behind him and he is protected from the explosion.

The first level is relatively easy to complete but from level two onwards the going gets tough. Convoluted corridors, artificial gravity generators which push you away from your goal, refuse crushers that turn you into space cabbages, all conspire to keep you from your goal. One way tubes suck you in and blow you out miles from your intended location. Life Support Bubbles appear in the strangest of places and their control panels resemble the force-field generators so closely that you can start the countdown before you realise what you've done.

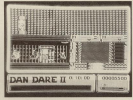
As you reach the higher levels, Treens and Space Fleet troops disappear into hidden passages. Keep your eyes open for this because these short cuts can mean the difference between life and death.

Assuming that you reach and complete the fourth level, there's a nasty surprise waiting when you meet the Mekon in an eyeball to fishbowl confrontation which really gets Dan Dare's dander up. Armageddon out of here!

When your proficiency level has reached mammoth proportions and you can whizz through the spaceship like a dose of assaults, it's not time to chuck the cassette in the bin because another challenge awaits – you can become the Mekon and try to beat Dan at his own game.

The Mekon's task is to release all of the Super Treens but desperate Dan has triggered off the destruct sequence. If you find the time limit tight as Dan, you'll never make it as the Mekon. To succeed you'll have to zip around the corridors at breakneck speed – no wonder the Mekon's green.

The programmers are credited as Virgin's Gang of Five. Judging by their results, Dan Dare II has been a labour of love and the graphics are some of the best planned that I've seen for a long time and the logic challenges even surpass its precursor.



The version that I received was a pre-release without music but the sound effects are sufficient to keep me happy. Anything over and above this would simply be a bonus but I would liked to have seen a Hall of Fame scoreboard.

Mekon's Revenge scores very highly on all counts and I hope that the Gang of Five get to work on a sequel very soon. Dan Dare – software of the future! **E.D.**

Touchline:
Name: *Dan Dare II – Mekon's Revenge.* ***Supplier:*** *Virgin, 2-4 Vernon Yard, Portobello Road, London W11 2DX.* ***Tel:*** *01-727 8070.* ***Price:*** *£8.95 (Ca) £12.95 (Disk).*

LORDS OF...

Nice guys end up with Madagascar! That's the warning issued to would be Lords of Conquest that take up the challenge to dominate the world in this Electronic Arts strategy game. This isn't an attack on Madagascar, but a reflection on its poor strategic location and how despicable Lords of Conquest players need to be to stand any chance of winning.

Lords of Conquest can be played by up to four players or on your own against a tough computer opponent and fought at three different skill levels, three different levels of luck and over 20 different predefined maps or one created by the computer or by you using the map creator!

The game is developed from a board game called Borderlands and so features easy to play board game gameplay combined with the flexibility and number crunching of a computer. Each game begins by dividing up the areas of the game map between the players with the game level, deciding who has first pick and in a one player game if either you or the computer has two or four bonus areas.

The game is then played in turns with each player allowed to launch two attacks into adjacent areas. The success of an attack depends on the opposing forces and support available from neighbouring areas. These forces consists of weapons (infantry) and horses (cavalry) in the basic game which can be transported about by boats in the intermediate and advanced, allowing attacks almost anywhere in the world.

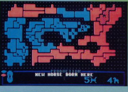
The object of the game is total domination by anhilating your opponents before they get you. In a one-player game this is a simple head to head battle, but in a multi-player game you just can't win on your own so you have to make and break alliances to suit your needs.

A basic game can be won or lost by the player who has control of the gold mines and horses rearing grounds. These produce the wealth and horses necessary to raise armies and create cavalry and with them launch attacks. You can also use your gold reserves to build cities that not only add to the defence of the area it's in and the adjacent areas but also doubles gold production in those zones.

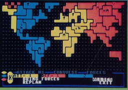
In more advanced games the gold and rearing grounds are joined by coal mines, iron ore mines and timber yards that all produce much needed resources at the end of each turn. In these more complex games the player must juggle these resources to build weapons and boats to carry his weapons and horses to foreign lands. For example, a weapon can still be bought for gold but also made with iron and coal. Similarly a city can be built if you have a combination of timber, iron, coal and a little gold.

Changing the luck level alters the certainty of combat. At its lowest level, combat is a simple matter of the highest total winning with the aggressor winning any ties. If you increase the luck you increase the doubt, since ties are decided randomly and at the highest level the chances of success are determined by the percentage of attackers and defenders.

Lords of Conquest is a superb strategy wargame that will bring the worst out of you. Either when you're tackling one of the nine levels of computer opponent or breaking agreements with human allies, you'll discover depths of treachery and deceit you never knew you had. The game displays these acts in dramatic style particularly during combat as other players that have states bordering on the action have to declare whether they will support the attacker or the defender. Then the fireworks really start as anything from "I pressed the button at the wrong time" to "we agreed I could take that state" being used as excuses. Whatever the arguments only one thing is certain and that is that there can only be one winner.



NEW HORSE BORN HERE



T.H.

Touchline:

Name: *Lords of Conquest.* ***Supplier:*** *Electronic Arts, Langley Business Centre, 11-49 Station Rd, Langley, Nr Slough, Berkshire, SL3 8YN.* ***Tel:*** *0753 49442.* ***Machine:*** *C64.* ***Price:*** *£14.95.*

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Constructing a Compiler

We kick off our new series with an introduction to developing your own compiled programming language

By Steve Carrie

This series is primarily aimed at the disk-based Commodore 64 owner although given a reasonable knowledge of the target machine, PLUS 4 and C128 owners (128 mode) could convert the programs as required. Over the next few months, I hope to show you how you can develop a new language for your computer and a compiler to go with it. As supplied, Commodore 64 BASIC lacks facilities to make effective use of the numerous features of this powerful machine. Many companies now supply programs and cartridges which will enhance poor old BASIC 2 into something resembling a modern programming language. Unfortunately, they do nothing for BASIC's sometimes painfully slow execution speed and while many compiled language systems do exist for the 64, they tend to be very expensive and thus out of the reach of many owners.

I'll describe my first attempt at compiler writing in the hope that it will inspire you to greater things. Writing a compiled language system is not as difficult as you may think. Perhaps the most difficult part is defining the language itself; the commands and their syntax. The language used here is called First Compiled Language or FCL; not a very original name I admit but it will do for now. FCL is a very simple language which provides facilities for handling unsigned integer values and also character strings. Some basic program control structures are provided and facilities exist for calling machine language subroutines. Certain features have been borrowed from other languages. Those of you familiar with *Pascal* may recognise certain FCL features such as BEGIN/END block marking and FORWARD subroutine declaration. The terms "Procedure Division" and "Data Division" have been borrowed from COBOL although they are used for reference only and do not require explicit definition within a program.

What is a Compiler?

In simple terms, a compiler is a program which takes a program written in a some language and produces a fast machine code equivalent. The term "compiler" is often applied to another type of program, the assembler. The major difference is that "compiler" is more often applied to a high-level language translator while "assembler" refers to a program which translates a particular microprocessor assembly language. In some cases (such as the FCL system) an assembler may form part of the compilation process, translating the output from the code generator stage. It is normal for the complete process to be split into stages. This allows certain parts to be updated as required and often eases the task of compiler construction since each part may be tested separately.

Many of the popular high-level languages are compiled; examples *PASCAL*. On the other hand, BASIC is usually an *interpreted* language (although BASIC compilers do exist). The differences are discussed later, but to confuse the issue, there is a sort of halfway house. The FORTH language system uses what is often referred to as an interactive compiler as it incorporates the best features of both systems.

Compiler Vs Interpreter

In an interpreted language system such as Commodore 64 BASIC, the program text is prepared using an editor which is normally part of the interpreter itself. This usually takes the form of a line editor in which a line of text is entered, prefixed by a line number which determines its position in the program. When the code is executed, the interpreter begins processing the text at the first line. Each line is scanned for language elements which will determine the operations to be carried out. The syntax of the line has to be checked as it is executed. The actual operations are carried out by subroutines which are part of the interpreter code. Once a line has been processed, the interpreter forgets all about it and goes on to the next line. Because the program has to be scanned in this way, the actual run speed tends to be slow. Compare this with the action of a compiler.

Once again, the program text is edited using some form of screen or line editor. Here the similarity ends. The compiler scans and translates the *whole* program *before* execution. In some cases, a form of pseudo-code is produced which is then executed by a fast mini-interpreter. In others, an actual machine code program is produced. The execution speed is considerably faster than an interpreted system because there is no need to continually check the syntax of each program line. Runtime support is provided by a library of routines which are either appended to the end of the final program or loaded into another part of memory at runtime.

When you turn on your C64, you can begin programming immediately in BASIC thanks to the interpreter which is held in permanent ROM memory. You can edit programs with the built-in editor, load and save your programs and RUN them. All of these features and more are provided courtesy of the BASIC interpreter. In addition to these, the interpreter will allow you to perform most commands outside of the program; i.e. in direct mode. The interpreter is interacting with you. Interpreters are generally *interactive* systems. This is useful when you have to debug a program. You can halt the execution of the program, check variable values, alter them as required and then cause the program to continue. Although execution speed may be slow, program development and debugging is relatively quick and easy.

When using a compiled language system, similar editor facilities are provided by an editor program which must be loaded into memory. Unlike an interpreted system, no interactive testing of the program may be carried out. Debugging the program is a much more complex affair due to the lack of these interactive facilities. Certain systems do provide debugging features but these usually take the form of a separate program, used alongside the executable program at runtime.

On the basis of this comparison, it appears that the interpreted system scores better on program development than the compiler whereas the reverse is true for final execution speed. From this, it would seem that some kind of interactive compiler would be ideal. FORTH goes some way to providing this seemingly ideal programming environment. FORTH is a language developed some years ago for the control of radio telescopes. The compiler provides many of the interactive features of an interpreter and once you get used to the peculiarities of the language itself, it becomes an excellent software development system.

The FCL Compiler System

The FCL compiler has been written in BASIC. Before you cringe, consider what I've said about program development and debugging. The only other option I had was machine language and it is considerably easier to develop the techniques in a high-level language. The BASIC on the 64 is, as we have seen, an interpreted language and the penalty is a painfully slow execution speed. You could use FCL to develop a new compiler so long as you don't mind having your lunch while it compiles...

The Bug File

This system isn't perfect I'm afraid. There are one or two problems with this version, which occur mainly within the library routines which provide the runtime support. Most are merely an inconvenience but the fourth point may cause a real problem. Here is the current list although I expect that there are some that I have not come across.

- The autoincrement and autodecrement operators do not work. It was intended that the ++ and -- operators would provide autoinc. and autodec. within expressions as in the C language. What actually transpired was that they would only work when applied to a single numeric variable.
- The DERR() function does not behave altogether sanely in some situations. I've found that a couple of dummy DERR()'s is a good idea. I've not been able to find why this happens.
- On some occasions, reading an INPUT file which does not actually exist may cause the machine to hang up. A RUN/STOP-RESTORE keypress will reset the machine.
- After an extended execution of a program using string manipulation and/or type conversion operators and functions, the memory fills up with redundant strings. Due to a design flaw (by yours truly) no garbage collection facilities exist nor can they be written for this version. The effect of this is for the program to stop with a memory full error after some considerable time. This may be OK for most applications since the memory given over to the storage of strings is considerable; the memory left free after the program is loaded which is normally in excess of about twenty-odd K.

The FCL Language

Before setting out to write your compiler, you should define the language. If you are writing a compiler for an established language then you need only follow the standard for it. Designing your own language is a challenge for both your programming skills and your imagination. When I originally started out on this project, my intention was to write some kind of super-assembler which would make machine code programming easier for beginners. As the project developed, I decided to be more ambitious and write a high-level language compiler. This brought its own special problem; that of language design.

The first thing I had to do was to define a programming language. At one point I thought about writing a compiler for BASIC 2, but decided to walk before running! And so the FCL project was born. The first thing was to define three groups of language elements; statements, operators and functions. These are defined as follows:

Statements are actual programming commands which cause some immediate effect such as screen clearing (CLS) or decision control (IF/ELSE/ENDIF).

Operators Arithmetic, logical and relational operations causing effect on one or more variable quantities. For example; add (+), multiply (*) or logical exclusive-or (XOR).

Functions Language elements which return a result when given one or more parameters. The LEN, ASCII and SYSFN functions are examples. These appear in an expression.

The next task was to decide what kind of data this language should be able to handle. Since this was my first attempt at such a project, I decided to keep things simple and allow only unsigned integer and character string types. Facilities for type conversion were considered necessary and so functions such as ASCII and CHAR were included.

The next section is basically a programmers' reference manual for the language. It details items such as variable declaration and explains each staement, operator and function. If you go on to develop your own language, it may be a good idea to write everything down in a similar form to this *before* you start to design and program your compiler.

FCL Programmers Reference

In the following document, *Italic* characters are used to highlight FCL language elements. The source editor, EDIT selects lowercase mode when executed. Please note that the FCL compiler will not accept uppercase characters except where they occur within string literals.

A FCL program consists of a variable declaration section, a program instruction section and optionally one or more subprogram instruction sections. The variable declaration part is called the Data Division and the instruction section is called the Procedure Division. These names are for reference only and are not required in the program unlike the COBOL language from which these terms are borrowed. Subprogram sections are subprocedures which have the same basic construction as the main procedure but are identified as subroutines by the *subroutine* statement.

All variables and subroutines *must* be declared before they are referenced. This means that subroutines should be placed in the program before the main Procedure Division or be pre-declared using the *forward* statement. If a subroutine has been pre-declared with *forward* then it must be defined elsewhere, typically after the Procedure Division.

A procedure section always starts with a *begin* statement and ends with the *end* statement. This is true for both the Procedure Division and any subroutines. The compiler will print a warning if it finds a variable declaration within a procedure but the variable will still be defined. An error condition occurs if the compiler finds a **program instruction outside a** procedure; i.e. in the Data Division. In this case, the instruction is ignored. Should any error occur during compilation, the creation of the symbol and literal data files will be suppressed thus effectively preventing code generation. Should only warnings be flagged then the creation of these files will proceed as normal.

The Data Division – declaring variables

All variables to be used in the program must be declared here. You may also pre-declare any subroutines which are not explicitly defined until after the Procedure Division. Variables are declared using the *var* statement along with descriptors *int*, *string*, and *array*. A variable of the type "**int**" is an insigned integer whose value may range from 0 to 65535 inclusive. A variable of type *string* is a sequence of characters of length up to 255. The *array* descriptor creates an array of either *int* or *string* types.

Variable and subroutine names must begin with an alphabetic character and may contain any alphanumeric characters thereafter. The maximum length of a variable or subroutine name is 20 characters. FCL reserved words may not be used as variable names. The name "a" is also illegal. Some examples of valid variable declarations are given below:

```
Var int counter,.maxcount
var string inputline
var int table array (10)
var string edit array (200)
```

While declarations of differing types must be made on separate lines, array and non-array variables of the same type may appear on the same line. Note also that you cannot dynamically define arrays i.e. *var int* xyz *array* (abc) where "abc" is an integer. You may use integer variables as subscripts in a procedure section only. Some examples of illegal declarations are shown below:

```
var int count, string line – dont mix types
var string table array (count) – no dynamic decl.
var int bset – bset is reserved
```

Pre-declaring Subroutines

Normally, a subroutine should be defined before the Procedure Division. The *forward* statement allows you to pre-declare a subroutine to the compiler thus allowing you to place it anywhere in the program. When you declare a subroutine in this way you must explicitly define it somewhere in the program otherwise the compiler will report an error.

The *external* statement may also be applied to subroutine names. This sets up a dummy reference during compilation. It is possible to use this feature to make special calls to machine code programs in memory at runtime. This is not a recommended method of making such calls. Refer to the *syscall* statement and *sysfn* function descriptions for details. Using *external* in this way involves editing the intermediate. ASM file produced by the CODEGEN stage. An example Data Division is shown below:

```
; Example of a comment line
; Example of a Data Division
Var int max,min,count,keys array(50)
var string userinput
;
; typical forward declaration
;
; forward getinput,printkeys
;
; explicit defined subroutines go here
;
; start of Procedure Division
;
```

The Procedure Division – begin and end statements

All program instruction lines must appear within a block bounded by a *begin/end* pair. This applies to instructions within a *subroutine* definition as well as those in the Procedure Division. The end statement generates different code depending on the context in which it is used. In the Procedure Division it generates a program termination sequence whilst in a subroutine, it generates a return-from-subprocedure sequence. Should any instruction line appear outside of a *begin/end* block then the compiler will report an error.

Numeric Expression and Literals

The compiler is capable of handling decimal, binary, octal and hexadecimal numeric literals. In an expression, the way in which the compile will interpret a literal numeric quantity is determined by a special character prefix. The dollar ($) denotes hexadecimal; the percent (%) denotes binary; the # denotes octal. Should there be no prefix, the compiler assumes the literal to be decimal, the following examples will hopefully make this clearer:

$8000	Assumed to be a hexadecimal number.
%1011	Assumed to be a binary number.
# 741	Assumed to be an octal number.
3212	Assumed to be a decimal quantity.

Note that depending on the number base used, certain characters may be considered illegal i.e. octal only uses numeric characters 0 to 7 inclusive, 8 and 9 being considered illegal.

In a numeric expression you may include operators, numeric variables, numeric literals and numeric functions (i.e. those returning a numeric result). The compiler performs type checking on an expression and will report a type mismatch error should it detect any type irregularities such as an attempt to assign a string to numeric variable.

String Expressions and Literals

Only certain operations are allowed on strings such as concatenation (joining strings using +) and relational comparisons. There are a number of string functions available. An attempt to assign a numeric quantity directly to a string variable will cause a type mismatch error.

A string literal should be delimited by quotes ("). Any character may appear within a string including uppercase letters and ascii control characters. The total length of any string quantity must not exceed 255 characters otherwise a string length error will occur.

Subroutines

A subroutine is a sub-procedure whose structure is similar to that of the main Procedure Division but is declared outside of it. A subroutine consists of a *subroutine* statement followed by a block of program instructions inside a *begin/end* pair. The subprocedure may contain any of the program instructions which are valid in the Procedure Division including calls to other subroutines. Also provided is the *return* statement which allows the programmer to force a return-from-subprocedure from a point other than the *end* of the subroutine. Any attempt to place a subroutine definition inside any procedure will cause the compiler to abort with a fatal error.

To call a subroutine, you can either simply place the name of the subroutine on a line by itself or use the more specific *call* statement. Both will produce a call to the subroutine. An example is shown below:

```
; Example of the use of subroutines
;
; Data Division
;
var int maxcount,count
forward countup,countdown
;
; Procedure Division
;
begin
; Example of call by name only
countup
; Example of call by call statement
call countdown
end
;
; Subroutines
;
subroutine countup
begin
 <instructions>
end
;
subroutine countdown
begin
   instructions
end
```

Operator Precedence

The order in which operations in an expression are carried out is known as the order of precedence. The compiler will effectively rearrange the order of elements in an expression according to the following table which is in order from the highest to lowest precedence;

1. Functions
2. Decrement/increment (-- and ++)
3. Division/Multiplication (/ and *)
4. Subtraction/Addition (- and +)
5. Relational comparitors (< , > , >=, < > and =)
6. Logical operators (NOT,AND, XOR and OR)

Within the groups shown, precedence is from highest to lowest, i.e. in an expression AND would be evaluated before OR.

Multiple Condition Testing

As in BASIC you may test for multiple conditions in one line using a combination or the relational and logical operators. A TRUE condition evaluates as 1 (not -1 as in BASIC) and a FALSE condition evaluates as 0. This is also true for string comparisons; i.e. the result of a string comparison is a numeric quantity, 0 or 1. The following are examples of valid comparisons:

```
if count > 5or maxint=10*minint
(count)
result=inputstring=userstring
write 3*(inputstring=userstring)
```

Refer later for description of the *if* and *write* statements. Note that the system tests for a FALSE condition rather than a TRUE one. This means that in an expression such as *if* flag, the variable "flag" is tested to see if it contains the value of FALSE (0). Any non-zero value in "flag" will evaluate as TRUE.

FCL Program Statements

In this section, the following notation is used:

< address >	16-bit numeric value representing a memory address
< expression >	A sequence of operators and functions which will evaluate to a quantity
< variable >	Variable of any type
< num exp >	Numeric expression
< str exp >	String expression
< condition >	Expression testing some condition
< instructions >	A sequence of program lines
< channel >	Numeric expression representing a channel number
< filename >	String expression representing a valid filename
< writelist >	Any valid expression for output
< readlist >	Any variables for input

Square brackets [and] are used to denote optional parameters whilst a vertical bar (|) separates legal parameter options.

Setting memory locations: bset and wset

```
1. bset < address > , < numexp >
2. wset < address > , < numexp >
```

1. A single byte in memory at < address > is set to the value of < num exp > which must be in the range 0.255.
2. Two consecutive bytes in memory at < address > and < address > =1 are set to the value of < num exp > in normal lo/hi-byte order.

Program control 1: loop/while/endloop/when

```
loop [when < condition > ]
< instructions >
endloop [when < condition > ]
```

The *loop/endloop* pair allow a set of < instructions > to be repeated depending on one or more conditional expressions. The **while/when** options allow testing of conditions at the start and/or end of the loop.

With *loop while* < condition > , the loop will be entered only if the < condition > evaluates TRUE otherwise control is passed to the first instruction following the corresponding *endloop* statement.

With *endloop when* < condition >, an exit from the loop will occur only if the < condition > evaluates TRUE otherwise control is passed to the corresponding *loop* statement. Note that if no condition is tested for at either end then the loop will continue indefinitely i.e. an endless loop.

Program Control 2: if/else/endif

```
if      < condition >
        < instructions 1 >
[else   < instructions 2 > ]
endif
```

If < condition > evaluates TRUE then < instructions 1 > is executed. If the optional *else* clause is included and < condition > evaluates FALSE the < instructions 2 > is executed. The *endif* statement must be included in either case.

Input/Output 1: charout

Charout [# channel > ,] < num exp >

This is the basic character output call which outputs a single character whose ascii code value is < num exp > Normally the screen is used unless a < channel > is specified. In this case the < channel > must have been previously opened by the *fopen* statement.

Input/Output 2: fopen and fclose

1. *fopen < channel > , < filename > for input/output*
2. *fclose* < channel >

1. Open a disk file < filename > via < channel > for either *input* and *output*. The < channel > number must lie in the range 2-255 inclusive; channel numbers 0,1 and 15 are illegal.
2. Close a disk file opened via < channel >.

Input/Output 3: write

write [# < channel > ,] < writelist >

Output data to the screen (or < channel >). The < writelist > may contain numeric and/or string expressions. The write control characters (; ,') cause different effects. Normally, a carriage return will be output after a < writelist > . The semicolon and comma allow prevention of this thus allowing basic formatting to be carried out. Both force utput to commence at a specific position after the last print position; the semicolon at the next consecutive position and the comma at the next tab; the screen is assumed to be split into 5 tab positions at intervals of 8 characters. The apostrophe (') forces a carriage return.
Examples of *write* statement lines.

write "The answer is ";total
write'"Hello CBM!";
write 7, table(pointer)

Input/Output 4: read

read [# < channel > ,] < readlist >

This statement allows input of data at runtime into specific variables. You may only specify variable names in the < readlist >. Either string or numeric variables may be input. Variable names are separated by commas in the readlist. The cursor is switched on and input takes place at the current screen *write* position (screen only).
Examples of the *read* statement.

read table(count)
read startaddress,endaddress
read # 3,startnumber,name

Miscellaneous Statements: call,wait, halt,syscall

cls

Clear the screen and home the cursor to the top-right corner of the screen.

wait < num exp >

Causes the computer to wait for a specified time, the actual time period being given by < num exp >. Since the basic time unit is 1/60th of a second, a delay of 1 second is achieved with *wait* 60.

halt

Forces the program to terminate.

syscall < address >

Execute a machine code subroutine beginning at < address > . The subroutine must end with an RTS instruction. See also the *sysfn* function.

byte(< address >)

Returns the value contained in the memory location at < address >

word(< address >)

Returns the value of the word at < address > and < address > +1. Similar to *byte* except the a 16-bit value is returned.

len(< str exp >)

Returns the length of < str exp > . If the < str exp > is valid, length is always in range 0.255.

ascii(< str exp >)

Returns the ascii code of the first character in < str exp > .

stop(< num exp >)

Evaluates TRUE if the RUN/STOP key has been pressed. The < num exp > is a dummy parameter.

key(< num exp >)

Evaluates TRUE if any key other than shift, run/stop control or commodore has been pressed. The < num exp > is a dummy parameter.

charin(< channel >)

Returns a numeric character code from < channel > . If < channel > is zero, the keyboard is the input device.

iostat(< num exp >)

Returns the value of the I/O status bytes. In BASIC this the reserved variable ST. The < num exp > is a dummy parameter.

dstat(< num exp >)

Returns the disk status value i.e. the error code. Again < num exp > is a dummy parameter

String Functions

char(< numexp >)

Returns the character whose ascii code is given by < num exp > which must be in range 0-255.

atr(< num exp >)

Returns the literal of < num exp > as a string.

left(< str exp > , < num exp >)

Returns the let most < num exp > characters of < str exp > .

right(< str exp > , < num exp >)

Returns the rightmost < num exp > characters of < str exp > .

mid(< str exp > , < num exp 1 > ,< num exp 2 >

Returns a substring of < num exp 2 > characters from < str exp > starting at position < num exp 1 > .

sysfn(< address > , < str exp >)

Passes control to a machine code subroutine at < address > . Parameters are passed in < str exp > in the following format:
accumulator--x register--y register--flags

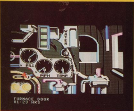
This four character string format is used to return the values of the registers in the same order.

derr(< num exp >)

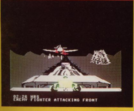
Returns the disk status string. The num exp > is a dummy parameter.

To be continued

THE TRAIN



FURNACE DOOR
01:23 HRS



02:26 HRS
ENEMY FIGHTER ATTACKING FRONT

By the end of the summer 1944, it was fairly obvious which way the war was going. Different Germans responded in different ways. Some tried to ingratiate themselves with the Allies and prove that they really were decent chaps after all and had only been obeying orders. Others tried to prepare for a life of luxury once all hostility had cesaser, presumably in South America.

One such German was Hermann Goering, Commander of the German Air Force, drug addict and art collector. The term collector is used in its loosest sense. He used the German occupation of France to appropriate as much of the French national art treasures for his own personal pleasure.

As the German armies withdraw from France, so a train filled with Monets and Renoirs heads for Germany and it is at the station of Metz that you, Pierre LeFeu, a member of the French Resistance first catch up with it. Your objective is to steal the train back and return it and its contents to the people of France.

It is midnight when you and your companion Le Duc attack the station. You must provide cover for him as he tries to board the train. This involves shooting soldiers who appear behind lit windows of the station building before they shoot you. Get hit once and it's game over time. No five lives here.

Le Duc signals to you when he is ready and all you have to do now is get the train back to western lines before dawn. Fortunately you do have some experience to give you a hand.

Operating the train involves coming to terms with the various controls in the cab. Throttle and brake are fairly simple, but you must also make sure that the furnace is well stoked if you are to maintain a good head of steam. There is a steam blow off facility – needed in case the boiler is about to blow up and you must learn the system of whistles which will alert the resistance to switch points for you.

As you progress you can monitor your position by summoning up a map screen. You will have to negotiate attacks from enemy night fighters as they attempt to strafe the train as well as gunboats when you cross a river. These boats cannot be outrun so you need to stop on a bridge and blow them out of the water before they can blow you up.

Stations are a different proposition. You can run them if you choose but stopping might be necessary in order to refuel. Once you have taken a station – played in exactly the same way as you attacked Metz, you also have the opportunity to send a signal to the resistance. You can ask them to take a bridge or station for you but they will only be able to hold it for two hours so it's up to you to make good time, especially if you want repairs in a station.

The game is excellent graphically and initial addictiveness is high. Control is similar to that in the game Dambusters in so much as you press different keys to give you different views – inside the engine, forward and rear facing guns and the map screen.

The gameplay is limited though being a lot simpler than Dambusters with the arcade sections being particularly easy after a while. Although you can try different routes and the three difficulty ratings in order to improve your final assessment, once I had completed the game, I didn't feel any great urge to return to it. **G.R.H.**

Touchline:
Name: *The Train.* ***Supplier:*** *Electronic Arts/Accolade, Langley Business Centre, 11-49 Station Road, Langley, Nr. Slough, Berks SL3 7YN.* ***Tel:*** *0753 49442.* ***Price:*** *£9.95 (Ca) £14.95 (Disk).*

Character Building

Get your sprites and UDGs ready for action on the starting grids

By Norman Doyle

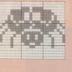
User Defined Graphics and sprites can lift a dull program into a new dimension. The ability to design a series of characters is an essential skill which, once mastered, leads the way to professional results in utility creation as much as in game production. UDGs are based on a simple 8×8 pixel grid but sprites are slightly more complicated to create on their massive 24×21 pixel grid.

Faced with the problems of standard and multicolour modes, the prospect for the beginner is overbearing but the hardest part is typing in the reams of data which make up the characters. With eight bytes per UDG and a possible 255 characters, the best way to enter the data is to use a graphic design program which allows you to construct a graphic on a grid and save a whole section of memory. This block can then be loaded from within the master program. A combined or companion sprite designer is also desirable but make sure that both programs have a multicolour option.

ROM Raiding

UDGs are similar to the characters that the ROM uses and if some of the ROM characters are needed on the same screen as the UDGs they have to be downloaded first. This is not a simple case of peeking and poking because the ROM is banked away out of sight beneath the I/O registers at 53248 through 57343.

When accessing the character ROM all I/O functions are disabled, including the keyboard so care must be taken to get this part of the program correct. If a mistake is made the computer will be as dead as a dodo until it is switched off and then on again. This is yet another reason for saving before running.



Characters and screen must lie in the same 16Kb section of memory and this will vary according to your needs. For this reason the ROM Raider routine in the Listings section has certain values which must be allocated before running. The block of characters which are moved by this routine includes the alphanumeric characters and all the punctuation marks, 64 characters in all. Each character consists of eight bytes and each bit of every byte represents a pixel when the character is printed onto the screen.

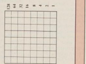


Fig. 1

Creating UDGs

UDGs use exactly the same size grid as the normal ROM characters – 8×8 pixels. Even if you don't own a character designer you can still define your own characters by following a few simple rules.

A character grid is shown in figure one.

Every row is stored as a byte of memory and the squares which make up a byte correspond to the eight bits of the byte. A pixel is turned on if a bit is set to one and turned off if the bit is zero. Each square has a value according to its position which is devised so that each value between zero and 255 gives a unique shape which covers all of the possible combinations of on and off pixels.

A character can therefore be defined as a series of eight decimal values as we have seen with the ROM Raider routine. On the screen the letter A looks like this:

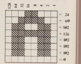


Fig. 2

The number beside each row is derived by adding all of the values at the top of a column which correspond to a turned on pixel in that row of the diagram. This can also be applied to a designed character:

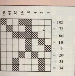


Fig. 3

Access to the new character set is achieved through the low nibble of location 53272 after all of the necessary bank switching and screen positioning has been completed.

Selecting where the characters lie in the character set requires a little bit of common sense. If characters are to be used it is best to allocate them the same values as the ROM uses. For example, the letter A should be the second group of eight bytes. This means that it can be placed on the screen by poking the value of 1 to the screen location where it is to be displayed, just as you would if you were using the ROM characters.

The colour of the character is stored in the normal memory map (55296 to 56295). To assign a colour to a character, a value must be poked to a corresponding memory location within the map. Any of the 16 colours can be chosen but a character moving across the physical screen map must have its movement shadowed by moving its colour around the colour map, it doesn't happen automatically.

Colourful Characters

Standard UDGs only use two colours, a foreground colour (switched on pixels) and a background colour (switched off pixels). This limits the visual impact of the character and the use of multicolour characters can help here, but at a price.

The multicolour character grid only has half of the resolution of a standard character – 4×8 pixels. This is because the colour information is stored on board the character by a clever use of paired bits.

The best way to design the character is to use colours or shading to represent each of the four permitted colours of the character. Always remember that one of the colours is limited to the first eight colours in the numerical sequence from zero to 15:

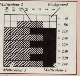


Fig. 4

The eight byte values for the character are calculated by allocating a value to the paired bits of each pixel using fixed regulations. Background colour is always designated as 00. Multicolour 1 is 01 (binary value 1). Multicolour 2 becomes 10 (binary 2) and Multicolour 3 is designated by 11 (binary 3). This correlation between the paired pixel value in decimal and the name of the multicolour type acts as a useful reminder when creating the characters. Substituting these values into the grid we derive the following values:

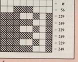


Fig. 5

The values look similar to those which were calculated for standard UDGs and it is difficult to tell them apart just by looking at the figures. Try to display a multicolour character and the differences soon become apparent. Just as ROM characters cannot be used as multicolour characters, so multicolour UDGs are often unsuitable for display in standard mode.

To switch the display from one mode to the other requires a single poke to 53270:

```
POKE 53270, PEEK (53270) OR 16
```

Multicolour mode can be abandoned by using a similar construct, substituting AND 239 for OR 16.

Colour Slots

The colour is selected for the three multicolour options in one of two ways. Multicolour 1 is taken from a value poked to 563282 and its neighbouring location, 53283, determines Multicolour 2. The values contained in these locations can be any of the colour values from zero to 15 but, without resorting to split screen machine code routines, they are the same colours for every multicolour character on the screen.

Well at least you don't have to worry about moving the colours around the screen!

Multicolour 3 is stored in the colour map and determines if the character is displayed in multicolour or standard mode. The C64 is a very unforgiving machine and I've always suspected that its designer was a Yorkshireman – you don't get owt for nowt and the price you pay here is a reduced colour range. The same sixteen values may be poked to the map but values up to seven display the character in standard mode with the assigned colour attribute following the normal rules. If the value lies between eight and fifteen, the character is displayed in multicolour but the colour of Multicolour 3 is derived from the poked value minus eight. This means that the C64 steps back to the old VIC days with only eight foreground colours available.

The multicolour mode is limited but can produce superb results if handled properly. Use its weaknesses wisely and the result can be deceptively more colourful. Across the whole screen, the only colour which can differ for each character is Multicolour 3, so use this as the main colour whenever possible, leaving the other two colours as shading or minor detail hues. If the two fixed colours are selected from the extended colour range (8 to 15), the colour range will seem wider and problems of colour clashes will be less frequent.

In both modes the background colour which shows through will be set by a poke to location 53281 but this is not always the case.

Extended Backgrounds

No pixel is actually switched off because everything on the screen is displayed as a colour. What we really mean by an off pixel is one which is turned on to display the background colour which is normally fixed for the full screen. In extended colour mode this rule is broken, but the cost is a very serious loss in the range of characters which can be displayed.

Instead of the usual 256 character set, extended mode only has 64. These are repeated four times and a different background colour can be assigned to each of the otherwise identical sets. The colours are assigned by locations 53281 to 53284 and depends on bits six and seven of the character's screen mode. Reflecting on this, you soon realise why only 64 characters are available. When the value of the screen character exceeds 63, the 64 bit is altered. Since this bit determines the colour, the system reverts to screen code character zero (the 'at' symbol) but with a different background colour.

The location that the colour is taken from is determined by the following table:

Bit Pattern	Colour Location	Code Range
00XXXXXX	53281	0 to 63
01XXXXXX	53282	64 to 127
10XXXXXX	53283	128 to 191
11XXXXXX	53284	192 to 255

The character colour is determined in the normal way using the colour map but only standard character mode can be used because the multicolour locations are used to select the background colours.

Extended mode is controlled by bit 6 of location 53265:

```
POKE 53265, PEEK (53265) OR 64
```

To turn the mode off again the OR 64 is substituted with AND 191.

Though this mode is limited in character range, it does include all of the alphanumeric and punctuation characters which makes it ideal for creating striking title or text screens.

Sprites

The same rules apply to sprites as apply to character defining. A sprite is just a movable block of characters with a skeleton that looks like figure six.

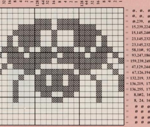


Fig. 6

The heavy lines in the grid show how the sprite can be broken down into character sized groups. The horizontal divisions are of little importance but the vertical lines are important when defining a sprite in memory.

Sprites consist of six character blocks with three half height characters. This is devised so that each sprite definition fits in a 64 byte block to make memory management easier.

A sprite definition for a single sprite row of 24 pixels is broken down into three groups of eight bits as shown in the diagram and these are written into consecutive bytes in memory going across all three values for each row in turn before starting on the next row.

The example shown in figure six would have a configuration for the first row of 0, 16, 0 and these would occupy the first three bytes of sprite memory. The second row would be placed into the next three bytes as 0, 56, 0. The other 57 bytes would follow the same pattern until the sprite was fully defined. This only fills 63 bytes. The extra byte serves no purpose but in cases where more than eight sprites are used this byte could be pressed into service as a store for the sprite colour (in multicolour mode this would correspond to Sprite Multicolour 2).

The problem is where to store all of this information. The VIC chip 16Kb rule applies to sprites in the same way as it does to screens and character sets. A quick bit of arithmetic shows that 256 sprites could be defined in a 16Kb block but in practice this is false because the screen and character set also need space within the block and, under normal programming conditions, only eight sprites can be displayed on the screen at a time. If room does not permit the full range of sprites to be held within the VIC's memory bank, a bit of slick shunting can move the necessary data into this area from elsewhere in the computer's memory.

Eight bytes at the end of screen memory control which block of memory the sprite definition is found in. These locations can be found by adding 1016 to the location of the first byte of the screen and the eight bytes from this location form the sprite pointers. For example, the normal screen starts at location 1024 so the sprite pointers start at location 1024 plus 1016 – location 2040.

The values stored in these locations determine the 64 byte block which is used. When a zero is placed in any of these pointers the sprite definition starts at the first byte of the current VIC memory bank. In the example used this would actually be the start of memory, location 0, which is not a good idea. A value of two would take the definition from location 64 to 127, which is no better. For the normal bank the sprites can only safely start with a pointer value of 32 but even this would place the sprite definition right at the start of Basic memory. A few sprites can, however, be squeezed in the cassette buffer (pointer values 13 to 15 : memory locations 832 to 1023).

Sprite colours are stored in the eight locations which start at 53287 and these colours relate directly to the order of the sprite pointers.

Before a sprite can be used, it has to be seen. Sprites are turned on through location 53296 whose eight bits behave like a row of light switches, turn a bit on and the sprite lights up. To control each bit is not simply a case of poking a value. The following syntax will serve any purpose:

POKE 53296, PEEK (53296) OR (2 ^SN)

For SN simply substitute the number of the sprite which you want to see. To turn it off again substitute AND (255-2 ^SN) for the DR statement.

Brighter Sprites

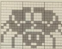
Sprites can also be displayed in their own multicolour mode which is totally independent of the character multicolour mode but follows roughly similar rules.

Once more the sprites pixels are paired horizontally giving a reduced resolution of 12 double-width pixels per row. This gives the possibility of four colour types: transparent and three colours.

There are no limitations applied to the range of colours in any of the sprite multicolour registers but two of the colours are fixed for all of the sprites on the screen at one time. This time the fixed colours are designated by bit pairs with a binary configuration of 01 (colour stored in location 53285) and 11 (stored in 53286). A bit pair of 10 takes its colour from the normal sprite colour registers starting at 53287 and can be varied for each sprite.

A byte pair of 00 is designated as transparent which means that any screen characters which it passes over will show through in these areas. It should not be confused with background colour in multicolour character mode. If this point is not observed the result would be, in the world's of Batman's sidekick, holey sprites!

If one sprite is in multicolour it does not follow that they all must be. Location 53276 is another bank of eight switches which can flick each sprite into multicolour mode. Turn it off and the sprite reverts to a strange-looking standard sprite.



Turning a particular sprite into multicolour mode requires the same kind of command that is used for switching sprites on:

POKE 53276, PEEK (53276) or (2 ^SN)

Substituting AND (255-2 ^SN) will turn the selected sprite back into a standard sprite.

Sprite and character defining takes up a lot of memory and from Basic it takes a lot of time to poke data into memory. To help save time the Character Saver listing can be typed in and used. Load the saver program before you start to define your sprites. Poke the sprites into position and calculate the start and end memory locations of the block which holds the definitions. Typing SYS 49152 will set the program in motion.

See listings on page 98.

80 Column Video

We take an in-depth look at the 8563 chip which controls the video display of the C128

By D. Anderson

Perhaps one of the most interesting aspects of the Commodore 128 is the 80-column screen. Indeed, the 8563 chip which controls the video display, has some very interesting aspects within itself. An examination of the memory map, reveals that the 8563 has only two locations reserved for it. This would tend to indicate a very simple chip, without any of the 'frills' of earlier Commodore graphic chips – after all, two registers can hardly control any earth-shattering effects.

However, Commodore have employed an unusual trick in implementing this chip. The usual method of allowing access to a chips registers, is to map them into memory – this means that they can be accessed directly with a simple POKE to the desired register. However, with the 8563, we have a seldom used method, in which just two locations are reserved in main memory. In order to write to a register, the register number is placed in the first location, and the value to be inserted into it is placed in the second register.

For Commodore users, this may seem a rather long winded way of doing things, but it does have its advantages; namely, that very little I/O space is required. Anyone familiar with the old Color Genie will recognise this technique.

The surprises do not stop there! If you search through the memory using the monitor, looking for the 80-column screen, you will not find it. Where has it gone? Well, the answer, is that it is not in the memory. Strange, you may think, but true! The 80-column screen is in its own self-contained 16K or RAM, which does not appear in the memory map. To access this, data must be sent through the two 8563 I/O locations. Again, long winded, but it does mean that your text screen does not gobble up any of the main memory.

So, when Commodore tell you that you have just bought a 128K computer, you can tell them that they are wrong – you've got a 148K computer (128K main memory, 16K 80-column screen, and 4K of I/O memory). How many 148K computers do you know? Not many !

Now for the bad news ! Due to the complicated method of accessing the 8563, it means that your M/C programs will be more complicated, and a little slower (although if you switch to 2MHz mode, this should compensate for this).

The two locations in memory for the 8563, are $D000, and $D001 – register in $D000, value in $D001. Some quite startling effects are possible by playing around with these two registers, including moving the screen position, smooth scrolling, partial screen blanking, and many others.

Now, I expect you want to know how to manipulate the text screen – first, you need to know how to use the two locations to store this data on the screen. By investigating the kernal print routines, I have been able to find the locations which are necessary for this. By the way, if you wish to explore the C128 kernal, the same addresses as used on the C64 can be used – as a jump table has been inserted, so that calls to the kernal will still be to the same place.

Register	Meaning
$12	– high byte of the memory location to be manipulated
$13	– low byte of the memory location to be manipulated
$1F	–contains the value to be stored

Next, we need to know how the video memory is set out. By sending codes to the video memory, I have been able to put together this breakdown of the memory:

$0000 – text screen
$0800 – attributes for text screen
$2000 – character definition data

Unfortunately, there are some bad side-effects to the indirect addressing of the 8563. Firstly, since it is acting on its own, independent of the main computer, you have to make sure that it has finished doing its last job before you ask it to do another. This is done by reading $D600, if the 8563 is not busy, then bit-7 of this is cleared. If not, we just have to wait until it is not. Secondly, when you write the address to be manipulated in registers $12 & $13, this is taken by the video controller, and it appears to change it. As a result, if you do not get your value to be stored in the memory in time, it ends up in the wrong place – very useful ! BASIC ends up being much too slow for this, and so unfortunately, to access the 16K of RAM, we have to use machine code. Figure 1 shows an assembly listing for POKEing a character onto the 80-column screen.

Figures 1 and 2

```
        LDX    $1F          ;select register to use
        STX $D600           ;store register value
LOOP    BIT $D600
        BPL LOOP            ;wait until video is ready
        STA $D601           ;transmit value to be stored
        RTS
```

If we want to read the contents of a cell on the text screen, then instead of writing the new value of $D001, we read the contents of $D001. Figure 2 shows an assembly listing for this.

```
        LDX    $1F          ;select register to use
        STX $D600           ;store register value
LOOP    BIT $D600
        BPL LOOP            ;wait until video is ready
        LDA D601            ;transmit value to be stored
        RTS
```

The attribute data on the 80-column screen, is considerably more complex than that of the VIC chip. Besides the usual colour definitions, it is also capable of flashing, underlining and reversing characters. Incidently, since the 8563 allows the character to be reversed through hardware, there is little point in defining a character set, where half of it is taken up by reversed versions of the rest – if you write your own software to use the reverse attribute.

However, the most important bit in the attribute byte, is the one which selects from which character set the displayed character will come from. This enables both sets of Commodore characters to be displayed simultaneously. (When shift/CBM is pressed, the whole screen does not change, as it does on the VIC chip's 40-column screen.) Since both sets are in the character definition memory at one time, this bit allows two character sets to be displayed simultaneously – thus allowing a character set of 512. If you wish to manipulate this attribute data, it is done in exactly the same way as placing characters on the screen, except that the position of the video memory is different. (See the memory map given earlier.

Re-defining Definitions

Now, as I said earlier, the definitions of the characters are all stored in the RAM, so to alter these, we just read new definitions into this, and hey-presto ! No need to bother about switching ROMs in or out, and no need to bother about interrupts, as in the VIC chip. Program 1, presents a program that allows you to re-define the definitions, and to subsequently save them onto disk. The machine code data which contains check digits, so any errors are reported, contains the routines already discussed – storing characters on the screen, altering the attributes, and altering the character definitions.

Since the video RAM does not appear in the normal memory map, it is not possible to save it on a peripheral. Thus, it was necessary to transfer it across into main memory, before this process was complete. Users may like to examine this code with the aid of the monitor. Figure 3 shows a simple breakdown.

Figure 3

$A000 – read value from video memory
$A00E – store the video memory into the main memory
$A03B – store a value in the video memory
$A049 – store the contents of $B000-$D000 into the video memory

Program 2 contains the routines necessary to retrieve a disk file of character definitions, and replace them into the video memory.

See listing on page 100

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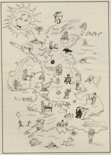

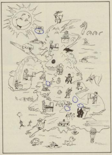

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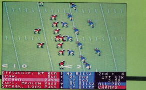
4TH AND INCHES



If the title of this game means nothing to you, the chances are you wouldn't want to buy it when you saw what it was about. American Football is one of those games like cricket that people either love or hate. There is no middle-ground.

It would be a pity if you did turn your nose up at it though, as it is the best simulation that I have come across so far.

Produced by Accolade, who also gave us the excellent baseball simulation Hardball, 4th and Inches is both easy to play and easy to get hooked to.

The game is entirely joystick controlled from selecting your play from a menu to manoeuvring key players as you try to complete the move.

You have two players available for each position. The coach's screen gives you an assessment of each player and allows to substitute at will. Each player is rated according to his speed and strength. The ratings are speed, fast, quick, steady, solid, strong, tough and big. In general, the faster you are, the smaller you are and vice versa.

There are eleven main types of offensive formation from which the computer selects five for you to choose from. These include shotgun, double tight end, short yardage and the various kicking plays. Once you have selected your basic formation, you must then choose the precise play you are going to attempt, be it running, passing or kicking. Medium passes out of a shot gun tend to work very well here. Occasionally you are fixed as the play you want to attempt does not feature in the list offered by the computer, but this is a minor quibble and most of the time you will have ample choice.

While you are doing all this, the defense likewise selects its strategies as it tries to outguess the offense. Should you line up for a pass or a running play or do you hedge your bets? What about blitzing the quarterback and if so, should you use your defensive backs or linebackers? A useful tip here is that the computer very seldom runs with the ball. Another nice touch is that if you are playing against the computer, your chosen plays are highlighted, but if you are playing against a friend, the plays aren't lit up so that both players can choose in secret.

Once all the plays have been chosen, it is time to put strategies into action. Into the offense, you control the quarterback once the ball is snapped and it is then up to you when you release the ball. Too early and your receivers will not have completed their patterns. Too late and you risk being sacked.

Once the ball has been passed or handed off, you take charge of the receiver and can then attempt to move down field as far as possible before getting jumped on by the opposition. Here again, it is necessary to know who you have just given the ball to. It is pointless trying to break tackles with your lightest fastest wide receiver – a side step should prove to be more effective.

The defensive player can select the man that he wishes to control although this may change as the ball moves down the fields. Only a small area of the field is shown at any given moment so if the ball moves any great distance, the play 'zooms' into the next section of the field.

Kicking, be it punting, or attempting a field goal or point-after requires you to time the kick properly. Misjudge and you will top the ball horribly.

Don't forget to watch the clock either. You have three time-outs each half, and it is essential to know when the clock will stop automatically, or you have to do it yourself.

The animation of the characters is excellent and unusual in American Football games. All twenty-two players are shown. The choices presented to you together with the tactics chosen by the computer ensures a wide open fast flowing game. The result is both extremely playable and highly addictive. Even if you don't understand all the formation names and what the players are attempting to do (a few more diagrams in the instructions would have helped here) you will soon get a feel for the action and it won't be long before you are calling the plays like an old pro. Very highly recommended.

G.R.H.

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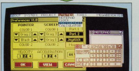

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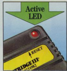

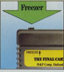

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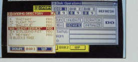

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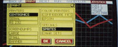

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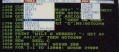

```
1350 CLR
1360 FOR          N$=N$+" "        NEXT
1370 GOS          THEN GOTO
1380 GET          IF ASC(Q
     THE          INT "GEEF UW NAAM"
1390 GOS          PUT "Q";N$:GOTO290
1400 RET
1410 REM     DEEL B
1420 PRINT "WILT U VERDER? ": GET A$
1430 IF A$<>"J" THEN GOTO200
1440 REM     DEEL C
1450 GOSUB 12300: GOSUB 280
1460 FOR T=1 TO 12000: GOSUB 29000
```

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Point to Point

Bit-mapped screens are difficult to handle but the resolution starts here

The high resolution screen on the C64 is enough to drive anyone dotty. After working out where the wretched thing can be stored you then meet the problem of how to draw a straight line. After several hours of grappling with graphic dots most people throw up their hands in horror, head for the nearest hostelry and get thoroughly pixel-ated.

One myth that we'll explode straight away is the high resolution misnoma. Even Commodore prefer to call the high resolution mode by its alternative name of bit-mapped graphics because the resolution is no higher than you get by employing user defined graphics. The bit-map screen is really 1000 UDG characters which completely fill the screen. If actual UDGs were used there would only be 255 characters, about a quarter of a screenful, but the number of pixels per square inch would be exactly the same. Despite this, the hi-res label has stuck and a mode by any other name still smells as sweet.

Bit-mapping is rarely used by programmers because it has the reputation for using up large tracts of memory and its peculiar arrangement makes programming difficult.

A single hi-res screen occupies 8Kb of memory for the pixel requirements and a further 1000 bytes for the colour information. Fortunately, it is possible to access the RAM which lies under the ROMs at 40960 to 49151 and 57344 to 65535. Using the latter area is best because Basic memory can be left intact.

To reconfigure the memory so that the VIC takes all of its information from this part of memory Bank 4 must be selected and then location 53272 can be modified to organise the locations of the colour map and the visible pixel screen.

Bank Transactions

Pixel screen placement is very limited – it can either fill the top or the bottom 8Kb of the 16Kb bank. The position is selected by Bit 3 of location 53272. If this bit is set, the pixel screen is at the top and a zero value is at the bottom end.

The colour map has to be placed where the pixel map isn't! When Bit 3 is set the colour map can be positioned at one of eight locations in the lower part of the bank or in the eight positions at the top of the bank when Bit 3 is zero. See Tables 1 and 2 for the possible locations and byte values.

In our case, the bank covers the locations from 49152 to the top of memory but an area to be avoided is 53248 to 57343, unless you're curious to see what a system crash looks like. This leaves two areas, one of 4Kb and another of 8Kb. It stands to reason that the pixel screen is going to be stored in the 8Kb block from 57344 to 65535. Where the colour memory goes is purely arbitrary within the bounds of 49152 and 53247; any 1000 bytes will do so we'll use those starting at 52224. This means that sprite definitions 0 to 47 can be stored in from 49152 upwards. The sprite pointers start at 53240.

The colour map controls two aspects of the screen colours. The high nybble is used to define the foreground and the lower four bits define the background. For example, if the screen is filled with byte values of 110, the binary equivalent is 01101110. Splitting this into two nybbles gives:

0110 = 6
1110 = 14

The result is the standard C64 screen livery of a light blue foreground on a dark blue background.

In the listing section there is a machine code program, Hi-res Setter, which sets the memory configuration and clears the colour map and pixel screen.

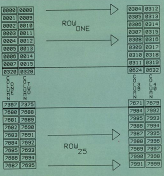
Screen layout

Hi-res mode is entered by:

POKE 53265, PEEK (53265) OR 32

To return to standard mode the command is:

POKE 53265, PEEK (53265) AND 223



In hi-res mode each byte in the pixel screen corresponds to eight pixels on the screen but the top line of the screen does not run along in consecutive bytes (0, 1, 2, 3, etc) but in increments of 8 (0, 8, 16, 24, etc). The second line follows a similar sequence (1, 9, 17, 25, etc). This may seem strange but remember what I said at the beginning: the bit-map screen is really 1000 UDG characters. A character is an 8×8 pixel block so the hi-res screen byte sequence goes down eight bytes, back to the screen top, across one byte and then down eight bytes again. This is shown in Diagram 1.

This means that programming is no simple matter. A straight line along the top of the screen would poke a value of 255 into byte 0, then into byte 8 and move on by jumps of eight until byte 312 is reached. If this is difficult just consider the problems thast diagonal lines pose!

What is needed is a system which allows a pixel position to be described by X and Y co-ordinates. This means that the pixel is found by counting across X pixels and down Y pixels. The range in the horizontal, or X, direction is 320 (0 to 319) and in the Y direction it is 200 pixels (0 to 199). The co-ordinates are written (X,Y) so the top, left pixel is (0,0), its neighbour is (1,0) and the bottom, left pixel is (319,199).

The way in which this is translated into actual screen bit positions is calculated in the following way. We firstly need to find out which character holds the pixel. There are eight bytes per character column so the column in which the pixel lies is given by:

```
COLUMN = INT(X/8)
```

Similarly the row is calculated by:

```
ROW = INT(Y/8)
```

To check this well use co-ordinates (319,9). The column is INT(319/8) or 39 and the row calculation gives 1. This means the pixel lies somewhere in the extreme right hand character on the second screen row – remember that the columns are numbered 0 to 39 and that the rows run from 0 to 24.

To find which of the character's bytes holds the bit we want we only have to concentrate on the low nybble of the co-ordinate value. There are eight bytes numbered 0 to 7 so the byte value is given by:

```
BYTE = Y AND 7
```

To finally pinpoint the bit is not so easy. There are eight bits so applying X AND 7 would render a value but the numbering of the bits would have to run from left to right for this value to be correct. Unfortunately, the numbers run from right to left so the bit equation becomes:

```
BIT = 7 - (X AND 7)
```

The actual byte on the pixel screen, which starts at a numerical location which we'll call BASE, is calculated by:

```
LOC= BASE+ROW*+COLUMN*8+
BYTE
```

To turn on the pixel we use:

```
POKE LOC, PEEK (LOC) OR
2 ^BIT
```

This all means quite a lot of calculations and it takes its toll on processor time. Hi-res Basic routines are slow and multicolour hi-res routines are even worse, which is one of the reasons why we won't be looking at them here.

Studying Form

One of the problems of using this area of memory is that although data can be poked to the screen it cannot be read back again without switching out the ROM. A short machine code and Basic routine will fix this.

The Hi-res Demo listing shows how the screen can be used. After setting up and clearing the memory, the program proper is entered at line 1000. The actual equation used for drawing the line is Y=mX, where m is calculated by (Y2-Y1)/(X2-X1) but if Y2-Y1 is zero the line is a horizontal bar and if X2-X1 is zero the line is vertical.

A trap routine is included to prevent Y or X from exceeding the screen boundaries otherwise a computer crash could result. The formulae for calculating the bit position are then applied but, before the final bit is poked into place, the Kernal ROM has to be switched out. To do this the machine code routine must know where to look for the byte under the ROM.To this end, the high and low byte of the location are derived from variable LOC and poked in reverse order to 250 and 251. During the SYS call the peeked value is stored and, on returning to Basic control, this location is peeked, bit modified and then poked back under the ROM.

The lines numbered in the 1000 range can be modified to draw many different shapes. A few suggestions are listed underneath the main program – substitute these lines and as a final project you could start to write your own drawing program using sprites and joystick control.

The only thing which can go wrong will show up if you press RUN/STOP and RESTORE. The reset that follows pokes a table of Kernal jump locations under the ROM causing the corruption of four of the hi-res character squares. It would be possible to write an interrupt driven program to store the 32 bytes from loction 64816 elsewhere in memory so that they can be restored if necessary.

Hi-res programming is a challenge which fully tests a programmer. A knowledge of maths is essential but even this is not enough to create efficient routines. Algorithms with strange-sounding names (Bresenham's line, Bezier-Bernstein approximations to name but two) have been derived to take advantage of the computer's pixel matrix. Many of these routines have later been applied to sprite movement to move them in strange patterns through calculation rather than under direct control. What happens on the hi-res screen can often be adapted for use elsewhere. This mode is a great teacher but a hard master.

TABLE 1 — High memory colour map locations.

Byte Value	Pixel map position	Map offset to add to bank base
9	HIGH	0
25	HIGH	1024
41	HIGH	2048
57	HIGH	3072
73	HIGH	4096
89	HIGH	5120
105	HIGH	6144
121	HIGH	7168
129	LOW	8192
145	LOW	9216
161	LOW	10240
177	LOW	11264
193	LOW	12288
209	LOW	13312
225	LOW	14336
241	LOW	15630

TABLE 2 — Bank Addresses

Bank Number	Base Address	End Address
0	0	16383
1	16384	32767
2	32768	49151
3	49152	65535

May I Interrupt?

Exciting game effects can be created with the help of interrupts and smooth scrolling

By Norman Doyle

If you want to learn how the professionals create perspective scrolling effects you have to understand two basic concepts. These are smooth scrolling and interlink interrupts.

If you've ever watched a scrolling Spectrum game, you'll have noticed the jerky movements of the background. The same is often true of the Amstrad CPCs, so why is the C64 different? The answer lies in the fact that the whole C64 screen can be moved a whole character to the right of its normal position. This is done in eight small stages, each of which corresponds to the distance between adjacent pixels. You may have heard this referred as a *hardware scroll*.

Try the following demonstration:

```
10 FOR A=1 TO 7:POKE53270,
PEEK((53270 AND 248) +A)
20 FOR B=0 TO 250:NEXTB,A
30 FOR A=6 TO 0 STEP-1:POKE
53270, PEEK((53270 AND 248)+A)
40 FOR B=0 TO 250:NEXTB,A
50 GOTO 10
```

A scroll based purely on this would hardly be stunning but consider one character in the home corner of the screen. Assume that the screen is scrolling to the right. After narrowing the screen down to 38 columns, the character scrolls eight pixels to the right (similar to program line 10):

Diagram 1

Then the screen jumps straight back to the original position (value 0). In the twinkling of a microsecond the character is poked to the column to the right of its original position. This gives the impression that it has glided bit by bit into its new position, just like a sprite moving across the screen.

Diagram 2

Then the procedure repeats but this time the character finished in the third column position. Once the character reaches the end column it is poked back across into the first column again.

For a demonstration of this phenomenon try the Character Scroll listing in the back pages of this issue.

You'll notice that the whole screen moved to the left, making this suitable for moving the 'scenery' about only. The whole screen is moved bitwise for eight pixels... no problem. Then on each row the characters have to be moved one position to the right and the last character has to be moved to the first column. This would give a wraparound effect.

This requires over 80 actions per line for the microprocessor or about 2000 actions per screen. Each action averages four or five cycles of the clock which surpasses the interrupt period.

There is a maximum of three interrupts which can be chained so that it seems that actions occur simultaneously. This makes it possible to scroll the whole screen but even then care has to be taken.

Most games require a scoreboard of some kind, so the example I have given allows for this and makes scrolling easier.

Splitting Images

In normal operation the scoreboard would keep jumping back and forth in sympathy with the changes in location 53270 ($D016). This can be prevented by splitting the screen.

Imagine that the screen is split at line 20. For a fraction of a second the screen is locked in position with a zero value in the lower three bits of location 53270. This allows a stationary image to be scanned onto the screen. When the first 20 rows of characters have been 'printed' to the screen the second interrupt runs a routine which scrolls the picture according to a value rising from zero to seven. This value is updated with each call to this interrupt and transferred from its storage location to 53270. At the start of the top of the screen interrupt this is changed back to zero for the stationery screen.

Diagram 3

All this happens so quickly that the screen appears to scroll in the bottom portion only, the top holds steady. A trick of the eye as well as electronic magic.

There's no reason why you can't change colours too. Last time we saw how interrupts could change borders and character sets to mix them on the same screen, this time we can break the rule that states that all multi-coloured characters have to have three colours in common (including the background colour) and one which can be varied. Now all of the colours can change within the area of the screen splits!

The Status Quo

All you have to remember is that anything you change in one interrupt has to be reset in the next. The status quo must be maintained if order is to prevail.

This is also true when returning to the main, non-interrupt linked, routine. Remember this and your half way to mastery of the screen. Also remember that the screen is scanned from left to right and top to bottom so vertical splits are out nomatter which way you scroll the screen.

Stretching these rules further, it is possible to add another interrupt to the screen, giving three distinct bands. One of these is stationary, one scrolls slowly and the third scrolls quickly. This gives a perspective effect if the characters used make the stationary screen the moon and stars, the middle split the far perspective and the third split the foreground. **Piperun** may seem like a long listing but it contains the necessary routines to show one of these pseudo 3D landscapes.

Once you have typed in the program, look at the moon. This is created by adding sprites to a character representation of the moon. The sprites form the bottom half of the moon in the second split and gives a realistic effect of the moon passing behind the mountain range. This makes the reality of the existance of split and such trickery is the key to good programming.

Piperun is well annotated and disection of the interrupt routines will give a clue as to what is happening on the screen.

Changing Direction

Scrolls don't have to occur in one direction. Splits can be used to scroll sections of the screen in opposite directions, at right angles to one another or even combine the vertical and lateral movements to allow multidirectional scrolling. Vertical scrolls are controlled by the lower three bits of location 53265 ($D011), so you might like to pay around with this and see what happens.

When you add joystick control with four optional interrupts a realistic left and right scrolling effect can be created. Joysticks wil be the subject of the next article, so until then enjoy playing with screen splits and scrolls without interruption.

Diagram 1

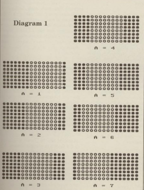


Diagram 2

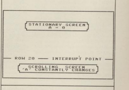
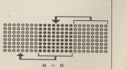


Diagram 3



First Steps

We move in on the computer addicts

By Norman Doyle

“Addicts are mugs. I don't do computing regularly. I can control it.” The scene jumps forward a few months to show an unshaven, dishevelled figure crouched over a keyboard. Piggy, bloodshot eyes peer out from under a shock of dishevelled hair – the video junkie mainlining on his stash of trash.

Over the top maybe, but there's more to computers than meets the eye.

I remember my first computer with great affection. In fact, I spent so much time with it that my girlfriend went off with somebody else and I hardly noticed! Computer addiction can damage more than your love life, however. Studies are currently being carried out in this country and the USA to draw up guidelines for people who use computer frequently. The cynics may scoff and say that many people spend as long watching broadcast programmes on their television but such outbursts only show the ignorance of the speaker. OK, I admit that a lot of time can be spent watching the box but consider the difference of televiewing with computer watching.

When have you seen someone only a matter of a yard or less from the screen? When does anyone watch so intently that they can't look away for a moment. The answer to both of these is when they are playing a computer game or programming. Some people may occasionally get so wrapped up in a TV show that they watch just as intently but this is for a relatively short period – some computer users do it for hours. All the time you're watching, the screen throws all manner of electromagnetic radiation and charged particles at you. What this accumulative effect may be is not yet known, but I'm sure it can't be healthy.

Of greater concern are the physical and mental effects that computers certainly do initiate. Eye strain, headaches and in extreme cases, crippling pains in the hands have all been attributed to prolonged computer exposure.

What can be done to avoid these risks? Obviously, limit the time you spend glued to the monitor. When you turn it on, decide how long you intend to use it for and adhere to your time limit. A couple of hours is quite long enough. You can then go and have a coffee, read a book on the detrimental effects of caffeine, get some fresh air. In fact, do anything but computing. You can go back later if you must, but remember you run the risk of the digital equivalent of sunburn if you sit there too long!

Not everyone is prone to the hazzards of computing but ask yourself, “Is it worth the risk?”

Lovely Mover

How can I be so gloomy on a day in Spring, the time of the year when a young man's fancy lightly turns to thoughts of programming.

Newcomers to the noble art of computing may be wondering what computer art is all about. How does it all work? Well, the computer screen is made up of tiny dots of light, called pixels (picture cells). By giving a different colour to groups of pixels letters, words, a whole new world can be created. Even movement can be simulated. Nothing actually moves on the screen, it only appears to – the haunted goldfish bowl strikes again!

Movement is achieved by switching pixels on and off in sequence, just like the light tubes festooning the hip-hop jock's disco box. As one light goes out another comes on and it appears that the first light has jumped from A to B. To get some idea of this try the following program:

```
10 A$="[HOME, RIGHT39"
20 PRINT"[CLR,SW]";
30 FOR A=1TO39
40 PRINT LEFT$(A$,A)" [SW]";
50 FOR B=1TO12
60 NEXT B,A
70 GOTO 20
```

Analysis of the routine shows that the screen is cleared and a ball is printed in the first column. Next a space is printed over the ball erasing it and another ball is printed in the next column. After a short pause, the program picks up the first two leftmost characters of A$ which causes the space to be printed over the ball again and another ball appears in the third column. This continues until the ball is printed in the last column and then the cycle starts again from the left.

Each time the ball is printed it is a different ball which is identical to the last ball. In other words the ball doesn't move it only appears to. In games where a little character walks across the screen, inspection of the memory will show that there are several little men, each displaying a different phase of taking a step. Showing these separate characters in quick succession gives the illusion of movement, just like a Mickey Mouse cartoon. Even the terminology is taken from the cartoon world, each character is called a ‘frame of animation’.

Frame at Last

The more frames that are included to describe the movement, the more realistic the movement becomes but the time taken to display the range of animations makes the action slip into very detailed slow motion. This would make a game very boring so most animation sequences are kept down to about four frames which repeat over and over again.

For an excellent example of animation buy, beg or borrow a copy of US Gold's Impossible Mission. It's been around a long time and is now available on a budget priced compilation. Despite its age, it's an excellent example of the art of games' programming.

Enjoy whatever it is that you do with your computer but, hey, let's be careful out there!

Character Grabber

Steal character sets from other programs with this handy C64 utility

By Andrew Leeder

Grab character sets from other programs and save them to disk or tape for later editing with a character editor (such as Cedit 64 from *Your Commodore* May '87). Character sets can be saved from anywhere within the memory with the exception of the 8K of RAM under the Kernal ROM.

Typing it in

Character Grabber is in the form of a BASIC loader, which should be typed in and saved before running it. When typing it in, cassette users should remember to make the appropriate changes. Next, type NEW and enter in direct mode:

```
POKE 8192,0:POKE 44,32:NEW
```

Now load and run the program that was previously saved. This will generate and save a new program name called "CHAR GRABBER" to disk (or tape). The loader is no longer required.

Using the Program

First of all, load the program with the characters you want to grab and reset the machine with a reset switch or cartridge with a built-in reset switch. Now load Character Grabber with LOAD "CHAR GRABBER",8,1 and activate it with SYS 4096.

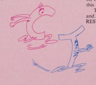
You will be presented with a screen split into two parts. The top half of the screen shows the current character set as 8 lines of 32 characters, therefore showing the full 256 characters of the set. The bottom half of the screen shows the video bank and character set numbers and instructions on use of the program.

The function keys (F1, F3, F5 and F7) are used to change the video bank number (0, 1, 2 or 3) and the '+' and '-' keys change the set number (0 to 7) within that bank. These keys are used to scan through the memory for the required character set.
Note: Sets 0 and 1 are not available in Bank 0 because they are used by zero page, screen memory and the program itself. Also, Set 2 in Bank 0 is partially used by the program also. However, this is not a disadvantage as most sets are usually stored in Banks 1 and 2.

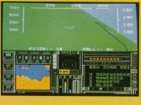
When the required set is selected and on the screen , press 'S' to save it. You will be prompted for the filename and the storage medium (tape or disk). All saved character sets will re-load at addresses 2048 through to 4095. Therefore the load address will need to be changed if it is to re-load at a different address. (There is a program on the 1541 demo disk which will do this as will many disk utilities.)

To exit the program, press SHIFT and X or alternatively RUN STOP and RESTORE. Type SYS 4096 to start.

See listings on page 98



Project Stealth Fighter



If this had been released a year or so earlier, it might have been the first computer game to cause a stir in the US Congress. Project Stealth Fighter is a combat flight simulator based on the F-19 'Ghostrider', the ultra-invisible warplane of which the Pentagon denies any knowledge, but which the whole world knows about – you can even buy a plastic scale-model kit of it.

In many ways this is an update of Microprose's earlier flightsim, F-15 Strike Eagle, but with the accent on stealth and electronic warfare. The F-19, apparently known to pilots as 'The Frisbee' is a strange-looking animal, more like a flying saucer than a conventional jet fighter. The idea is to avoid reflecting back enemy radar beams, which the spiky bits on regular jet fighters do. The penalty is an overall reduction in flight performance.

As a result, this package is more complementary to Strike Eagle, rather than supplanting it. The emphasis is on swiftly getting into enemy territory, performing your mission, whether this is the interception of an enemy aircraft or a ground strike, and getting out again, while alerting the enemy defences as little as possible.

Like the earlier flightsim, PSF features three-dimensional wire-frame graphics, however it applies these to ground features, not just to hostile planes. This definitely ups the realism quotient and the excitement, as does the fact that you actually have to land your aircraft at a friendly base. In F-15 Strike Eagle, you were safety home if you simply overflew your home base.

PSF also offers a vastly expanded range of weapons options (reviewing this game one starts to sound like an arms dealer – we are definitely talking about an enhanced-lethality combat scenario here). You get to toy with two different types of AA missiles, infra-red homing Sidewinders and radar- guided AMRAAMs, plus an extensive range of air-to-ground missiles, just about anything non-nuclear in fact.

Targets are either in the air or on the ground in four basic scenarios. The first one involves making life hell for the poor old Libyans, the next involves singeing the mullahs' beards over the Persian Gulf, and the last two, the hardest, are over Soviet territory. Various levels of difficulty are available, and you can always turn down one of the randomly chosen missions, if it looks bad to you.

Medals and/or promotions are awarded depending on results. This is where I found the game a little dull, compared with its predecessor. It awards most of the points for destroying the target, being undetected (flying slow and avoiding enemy radars) and getting back safely. As a result, the incentive to indulge in lengthy dogfights, which were the bits I enjoyed most in F-15 Strike Eagle seems much reduced, particularly as there isn't a lot of fuel margin left after you've subtracted everything needed to get to the target and back, and the F-19's flight performance isn't particularly wonderful compared with a Mig-29 Fulcrum.

Still, there's scope for a lot of adrenalin secretion here – the run in over a ground target can be particularly hairy – with Migs and SAMs blazing in from all directions, it's very easy to fly into the ground while trying to activate your infra-red and radar jammer and fire off decoys, let alone hit the target.

A nice touch too is the keyboard overlay, which can be configured to fit either the C64 or C128. Admittedly without it the game would be impossible, so many controls have been added. The documentation is excellent too, with a 115-page manual and a full set of mission maps.

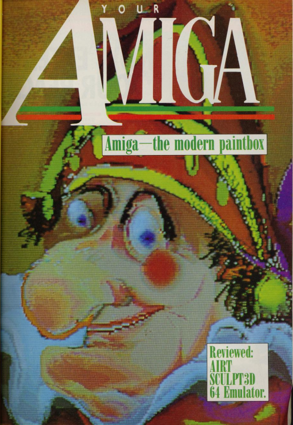
Microprose, possibly sensitive to criticism of the company's somewhat Reaganesque stance, has included a disclaimer in the package. It seems that the company really has nothing against anyone Islamic or Russian at all. If that's so, fellas, let's see you do a Mig simulation, with scenarios varying from Angola to Cambodia. Or how about a Hind gunship mission over Afghanistan?

Politics apart, this is a compulsive game, and one I played into the small hours. I'm not sure I'd swap my copy of F-15 Strike Eagle for it, though. **F.F.**

Touchline:

Name: *Project Stealth Fighter.* ***Supplier:*** *Microprose Software Ltd, 2 Market Place, Tetbury, Gloucestershire GL8 8DA.* ***Tel:*** *0666 54326.* ***Price:*** *£14.95 (Ca) £19.95 (Disk).*

YOUR AMIGA



Amiga—the modern paintbox

Reviewed:
AIRT
SCULPT3D
64 Emulator.

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Amiga News

Find out what's been happening in the Amiga world

By Anne Owen

FACC II - Floppy Disk Accelerator

Sometimes when the Workbench Notepad is asking the rhetorical question "Are You there fonts?" I am amused. Sometimes I wonder why the Amiga, a Porsche in every other respect, has a two-stroke under the bonnet in those grinding 3.5" drives. The new drives should be fast movers and 1.2 Kickstart has improved access times greatly. But you might like to look at FACC II if those icons still pop up to the drumming of frustrated fingers.

FACC II comes, via the Amigas Centre Scotland, from ASDG (easy to type that one), an American outfit with a background in Amiga utilities.

The Floppy Disk Accelerator relies on clever software to get as much information into memory as possible, thus decreasing access to the disk surfaces. The memory assigned is known as a buffer and the technique as disk cacheing. AmigaDOS has its own addBuffers command but FACC treat buffers as a common pool, while AddBuffers assigns buffers to a specific drive. FACC, ASDG claim, will also search 2048 in the same time as AddBuffers will just 16.

Because FACC II supports Fast Memory, the more add-on memory you have, the better the improvement in performance. (Add-on memory is always Fast Memory.) It also clears buffers intelligently so that applications don't crash)

To install FACCII it is suggested that FACC II and LIBS.ASDG are copied to your usual work disk. If this is an A500 Workbench then there isn't enough space. You will certainly have to get rid of the demos drawer and perhaps the utilities drawer to make room.

FACC II can be accessed from the CLI or Workbench (slightly restricted form). The former is via Satisfacction, the latter via Facction! These tools allow the number of buffers to be changed.

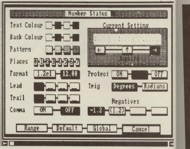
Also on the disk and one for your System drawer is Sysmon, an unrelated program which displays behind the scenes data such as RAM used and processes in action.

ASDG have gone for disk based documentation and very good it is with user and programmer manuals in their appropriate drawers. Full details are given on installing FACC II with example command lines and startup sequence text. There is also a demonstration.

The speeding up to Amiga disk access can be nothing but good and I experienced no problems with the programs I used while FACC II was installed. A simple benchmark of the extra speed was the opening in sequence of all the drawers on my Gizmoz disk. Each window has a number of icons to display and the time taken was halved with FACC II installed.

Touchline:
Name: *FACC II.* ***Price:*** *£24.00 inclusive.* ***Machine:*** *Amiga.* ***Supplier:*** *Amiga Centre Scotland, 4 Hart Street Lane, Edinburgh, EH1 3RN.* ***Tel:*** *031-557 4242.*

K-Spread2



Status Detail

Yet another spreadsheet for the Amiga, this time from English software company Kuma. K-Spread2 was one of the first programs available for the Atari ST and it's the first British spreadsheet for the Amiga. It is released in the wake of Analyse! and Maxiplan from the USA.

Cheapest of the three at £79.00, K-Spread2 lacks some of the advanced facilities of its rivals, notably the programming languages. However K-Spread2 does use the Intuition (WIMP) interface, provides block move and copy, table lookup facilities and macros.

Kuma's claim that K-Spread2 is easy to use and will take only brief training before full use can be made of it as a valid one. K-Spread2 however is a little unusual in its presentation with one window for entering data and manipulating functions and one window for the sheet itself. The latter can be resized or scrolled. Each window has a separate set of pull-down menus which become active when the window is clicked.

K-Spread2 also provides business graphics in line, horizontal/vertical clustered bar and horizontal/vertical stacked bar charts.

Printer support is ingeniously simple with codes entered in spreadsheet boxes. These can be Epson codes or ANSI codes ready for translation for the printer currently selected in Preferences.

An interesting design but there's tough opposition in the more comprehensive Maxiplan and Analyse!, now bundled with Scribble! and Organise! as Works, itself being sold as a small business package with the A500.

Touchline:
Kuma Computers Ltd, Pangbourne, Berkshire. ***Tel:*** *07357 4335.*

Demonstrator

This original package from Meridian Software allows you to record, edit and replay sequences of commands or "happenings". Demonstrator can be used from the CLI or the Workbench, in which it uses the "info" item tool types to set parameters. It can record key strokes and mouse moves and recordings can be made to loop continuously.

There are "terse" and "verbose" modes of recording. On playback, the former completes a sequence in rapid jumps while the latter shows the complete sequence of actions and is used for "demonstrating" applications.

A trade mark of Meridian is the hotkey control of their programs. Amiga key plus function keys are utilised in Demonstrator to start, pause and exit record or playback. A status window can be displayed. Default files, which start Demonstrator with certain parameters such as speed, lock-out keyboard control, update frequency and status display on/off, can be edited.

DemoPlayer is an invisible "task" activated from the Workbench or run from CLI which activates events by reading from a recorded file. One thing that has to be noted is that DemoPlayer knows nothing about its current environment so must always start from an identical position on playback as when the file was recorded.

A recording engineer in any field needs editing facilities. Demonstrator records a series of events into an event file. Two utilities, DemoReport and DemoCompile convert this file between event data and ASCII and back again. While in ASCII form you may use any text editor (ED for instance) to make changes and raw key codes are included in the manual.

There are mnemonics for events and special event commands which allow you to structure a playback and to add text in windows on the screen (ideal for a tutorial program) and also to run CLI commands e.g. RUN SAY "Welcome to Your Amiga".

Meridian's Demonstrator manual is clear enough with all the required information on one page and without too much cross-referencing. The obvious applications of Demonstrator are for initial training in database or spreadsheet work and for demonstrations by those selling Amiga software. Demonstrator can also be used for (restricted) educational tutorials. An original piece of software looking for somewhere to go.

Touchline:
Name: *Demonstrator.* ***Supplier:*** *Meridian Software, P.O. Box 890408, Houston, TX 77289-0408.* ***Tel:*** *(713) 488 2144 (USA).* ***Machine:*** *Amiga.* ***Price:*** *$45.00.*
Originality: *9/10.* ***Useability:*** *7/10.*
Documentation: *7/10.* ***Value:*** *7/10.*

AmiExpo Show Report

Our intrepid Stateside reporter takes us through the recent Amiga show in California

By Lewis Tilley

DESKTOP VIDEO

At this AmigaExpo the proliferation of programs for manipulating moving video images leaves no doubt that although the Mac got a jump on desk-top publishing, the Amiga is setting the standards in hardware and software for the world to come in desk-top videos. The NewTek Video Toaster is actually here. "Real time, full colour digitising, real time digital colour effects, and a broadcast quality genlock all in one system". Even more add-ons are promised. Soon there will be a chroma-key video switcher and an NTSC (US) paint program. There was no estimate of when the PAL version of this beauty will be released, but did you know DigiPaint by New Tek is out in a PAL version?

Digital Creations showed its new Supergen Genlock and overlay device. A-Squared continued to astound with its LIVE! real time video frame grabber. Brown and Wagh is now selling TV*TEXT and other Zuma Group products such as the showcase TV Show for IFF pictures using both NTSC and PAL video standards.

Microillusions continues to release modules in its Photon series. Photon Video is to be a complete video animation system. The demo of a Norseman galloping in a loop was smooth indeed. It was Photon Paint, however, which amazed me with its beyond DigiPaint features in H.A.M. Seventeen year old Oren Peli from Tel Aviv is the designer, who was eager to get out to Disney Land since it was his first visit to the States!

DESKTOP PUBLISHING AND WORDPROCESSORS

The new breakthroughs in Amiga software may well incense IBM and APPLE to send destruction aimed at the Amiga's competition in desk-top publishing programs. We now have two distinct classes of publishing programs. AmiExpo's seminars identified the distinctions well. There was "Desktop publishing-Entry Level" which featured Steven Wagh with an updated Publisher 1000 renamed Publisher Plus. It no longer uses a dongle, and it has added to its dot-matrix capabilities the most important new feature for smooth printing – PostScript laser support! (Brown-Wagh Publishing distributes it.) Look out for a new wordprocessor from them called EXCELLENCE. Steve Wagh says that it will rival WordPerfect in its strength.

Brown-Wagh has suddenly mushroomed as a top distributor of excellent software. Their "publishing partners" now include Micro-Systems, Northeast Software Group, SoftWood Co. and Zuma Group. They also will be handling PAR Software in the future. Jim Bell with PAR demonstrated a new Paint program which is also a new text program, too. Called EXPRESS PAINT, it features unlimited font use, imports text from most wordprocessors and has a maximum "canvas width up to 8192 pixels" and a *smooth* vertical scroll limited only by memory. WOW! I hope to be reviewing this new paint/write disk soon.

Jim Bayless of New Horizons Software showed his ProWrite which holds its own as a multi-font colour graphics word processor and FLOW which is an idea processor that almost reads your mind. Gold Disk's PageSetter and LaserScript, which has set the standard for Amiga publishing, can also be classified at this level. With such power, why were these fine desktop publishing disks called "entry level"?

The answer lies in Amiga publishing software's third generation. The seminar on "Professional Desktop Publishing" told us why. There shall soon be a battle of the giants as Gold Disk with its Professional Page comes head to head and font to font against Soft Logik's Publishing Partner Professional. Both are what Amiga has needed to be taken seriously as a competitor. Both put out PostScript files as easily as the IBM and the Mac can. This means that the Amiga has finally turned professional and may be used with standard laser printers, including Apple's LaserWriter. Soon *Your Amiga* can bring you exciting information about these near equals to the ALDUS Page Maker and Ventura Publisher.

Who knows, maybe Aldus and Ventura will port over to the Amiga like Wordperfect has done with its total wordprocessing program which is a professional printing program in itself. They announced a new collection of desktop programs for the Amiga called Library. It consists of a filer called Notebook, a Calendar, Calculator, File Manager for creating directories and a Program Editor. WordPerfect, incidentally, runs the best telephone backup service for their users which I have ever used. A small bug in an early version of WordPerfect elicited a call to them from me. Not only was my question answered by a special Amiga adviser (they have separate people for IBM and Apple), but I was sent a complete set of update disks the next day at no charge! If only other software house would adopt such practices.

MUSIC

Music-X from Microillusions is represented as a "state of the art professional music software". The integration with mounted keyboards and Midi interfaces certainly demonstrated the validity of this claim. DR. T's line of Music Software is now committed to the Amiga as well as the Mac and AtariST. Their KCS V1.6 is now available with essentially the same features on all three. Only serious musicians should investigate this rapidly growing producer of "serious software for the thinking musician" for they truly live up to their motto.

Ami Expo

Act 1, Scene iii: Hotel West Bonaventure (with apologies to W. Shakespeare's Julius Caesar)

Thunder and lightning. Enter, from opposite sides, Antony Jacobson with his sword drawn, and Lew Tilley.

TILLEY *Good morn, Publisher Jacobson, Brought you the large man and the bearded one to this California, U.S.A.? Why are you breathless? And why stare you so?*

JACOBSON *Are you not mov'd, when all the sway of earth*
Shakes like a thing unfirm? O Tilley,
I have seen tempests, when the scolding winds
Have riv'd the knotty oaks, and I have seen
The ambitious ocean swell and rage and foam,
To be exalted with the threatening clouds.
But never till tonight, never till now,
Did I go through a tempest dropping fire.
Either there is a civil strife in heaven,
Or else the world too saucy with the gods
Incenses them to send destruction.

TILLEY *Why, saw you anything more wonderful?*

Jacobson never answered for he busily gathered up the book of old jokes by Joe Miller he had found in America and scurried away to a corner of the awe inspiring hotel Westin Bonaventure, where he prepared an unexpected talk for Sunday on the European AMIGA situation.

Tilley, left on his own, descended to the maelstrom of eight thousand eager Amigas fans attending the opening day's displays. During that weekend Tilley saw enough computer "sauciness" during the second AmiExpo held in the U.S. to justify the Gods sending one of the worst wind and wave storms to hit the Southern California coast in its recent history. Was it mere coincidence that last October's devastating earthquake in California shook-up the participants in an all-Commodore show held in Annaheim at the DisneyLand Hotel?

STILL IMAGING

AmiExpo offered an opportunity to view two of the leading contenders in 3D programs – AEGIS' interactive Videoscape 3D and Byte by Byte Sculpt 3D/Animate-3D. It was disappointing that Impulse didn't have their new Silver ray tracing animation demo there. It would have been most informative to be able to compare these imagizers side by side.

NewTek was very evasive about the release date on Digi-Paint. Although a broadsheet (flyer) was in circulation, along with their Video Toaster announcement, which described a paint program which would not need preliminary work with DPAINTII, Ms. Longfellow remained tight lipped. Often at an exposition the big exhibitors so overwhelm us that small companies, the two guys programming and publishing from their garage, escape the notice they deserve. Lest this happen in this report, here are some small but very important software producers that you want to investigate. R.G.B. Video Creations provides interactive tutorials for DeluxePaintII, DigiPaint, Calligrapher and Page Setter. If you use any of these programmes, you need DeluxeHelp's tutors!

S.Anthony Studios' two guys, one a programmer the other an artist, have teamed up with A-Squared Dist. Inc. (who handle LIVE!) to sell their inexpensive "PostScript text and page layout Utilities for Amiga, AppleII and MS-DOS". They offer Laserup! Print1.2, Plot, Laserfronts Vol.1 and Utilities! These programs enable you to convert almost anything you want to PostScript files which will print on the available Laser printers to give a professional look to your publications. The PRINT program will even do a four colour separation. Write them directly at 889 De Haro St., San Francisco, CA 94107. Tell them Lewis Tilley sent you!

Games? Sure, there was always a crowd lined up along Microillusions' wall of four booths, but this was no "game show" type of expo. This was the "over thirty" crowd looking for solutions to their video, design and publication problems. The only positive mention of games came from a substitute speaker, Antony Jackson from London, who replaced R.J. Mical at the last minute Sunday morning. He gave Defender of the Crown credit for reversing the fortunes of the Amiga in the UK market.

Lead-off Keynote speaker Jay Miner, acknowledged father of the Amiga in Los Gatos, California, reiterated his history to its development much as he had done previously at the first AmiExpo in New York. It was over the dead bodies of the original financial backers of the small company that he and Mical crammed the great heart and mind of the Amiga into the cheap game machine envisioned by the developers. He was directed at one time to remove the H.A.M. feature (which now gives the AMIGA 4096 colours on the screen at the same time). H.A.M. was left on only because it would have been more expensive to remove it at that late date. He expressed regret that "half-bright" has been revealed. He had hidden the feature within the design with secret ideas of future colour expansion for it.

Miner is not only very proud of the Amiga 1000 which bears the paw print of his dog inside its case, but informed us of his final gift to the future Amigas. His team at Los Gatos finished the design of the next generation of video chips which will make possible 1024 × 1024 resolution along with two megabytes of available memory. When? ....?

N/C
42
Los Gatos '86

Amiga Games

What's new in the Amiga World? Read on!

Ninja Mission

Oh no, I hear you groan, not another Kung Fu/Martial Arts fighting game! But the nice thing about Ninja mission is the price. Where some software vendors have been charging full price for their games, Ninja Mission is under £10 – a price more suited to Commodore 64 games.

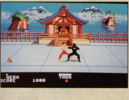
It's the same old scenario though – you have to enter a building, and systematically kill all the inhabitants, collect a few items and get the hell out. However in this case your opponents are fully trained Ninja fighters – thugs (in the ancient sense of the word) and a special bit at the end of the game (at least I think it is).

Add to this the fact that these fighters also start throwing darts and stars (shuriken), and you have a recipe for total mayhem on an Amiga scale.

The nice part is that if you kill an opponent and he is of the throwing star type (sorry I can't think of a better way of putting it) then he will drop his stars, leaving it up to you and his companions to fight over the stars, ending up with a lot of dead bodies.

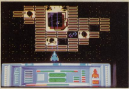
The game isn't without its faults – some sleepy programming creeps in whereby the dead bodies are piled up in the opposite end of the room when you re-enter it at a later date. Another "fault" is that on some occasions the music and the fighting stops, leaving you to fight with no feedback whatsoever.

Apart from these "hitches" I can say that Ninja Mission is a good game, not brilliant, but good – and definitely something to keep in mind if you are looking for this sort of thing. Otherwise avoid it like the plague. **M.B.**



Touchline:
Name: *Ninja Mission.* ***Supplier:*** *Mastertronic, 8-10 Paul Street, London EC2.* ***Tel:*** *01-377 6880.* ***Machine:*** *Amiga.* ***Price:*** *£9.95.*
Originality: *3/10.* ***Graphics:*** *4/10.* ***Playability:*** *5/10.* ***Value:*** *4/10.*

Insanity Fight



Microdeal are at it again with an interesting variation on Galaga. But this time, you have to avoid the buildings below your ship, and make sure you don't get hit by rockets fired from cannon bases and a massive destructor ship that comes down from the top of the screen – just when you don't want it to.

The aim of the game is naturally enough, to destroy everything in sight, destroy all of the swirling alien formation flying ships, cover as much terrain as possible, and look after the reserves of energy and firepower whenever possible.

There are a few nice touches, such as the sampled speech and the effective, albeit brief, animated "wink" – but then it lets itself down by 15 seconds of disk grinding – oh well, it gives me enough time to snap open a cherry coke!

What makes this game a little different are the various symbols that are dotted over the terrain. Fly over these and you earn a number of defences: invisibility, more power, transposed controls (a nasty one that), and a whole host of other items, some of which are useful, others just a pain in the butt.

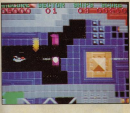
After the first level, it becomes clear that this is a game for people with a good memory – or with a map. There is a promise of a screen construction set in the near future which doesn't excite me very much (does it you?).

To be honest, there are so many of these games of this genre around already, I don't know why Microdeal bothered releasing Insanity Fight. It is an exceptionally crass shoot'em up with very little to offer above that of better versions such as their excellent Goldrunner released a couple of months back.

Sorry Microdeal, you can and have, done better than this. **M.B.**

Touchline:
Name: *Insanity Fight.* ***Supplier:*** *Microdeal, P.O. Box 68, St. Austell, Cornwall, PL25 4YB.* ***Tel:*** *0726 68020.* ***Machine:*** *Amiga 512K.* ***Price:*** *£19.95.*
Originality: *5/10.* ***Graphics:*** *4/10.* ***Playability:*** *5/10.* ***Value:*** *5/10.*

XR-35



Anco software are at it again with a new set of budget releases for the Amiga – but with XR-35 they are clearly out to make value for money games.

There isn't a story with this game (thankfully) and the idea is to shoot anything and everything that flies towards you. The basic story line is similar to a hundred and one other games, but the sprites are wonderfully detailed (as they should be), the backgrounds scroll past you very smoothly, with some very nasty looking "missiles" that don't do you any good should you come into contact with them.

The sprite animation is probably the fastest I have seen in a long time, but what really lets this game down is the time consuming disk loading between games. I mean is this really necessary Anco? A 512K machine reduced to 20 seconds of gear crunching between every game?

XR-35 looks more and more like the Coin Op classic "Salamander" the deeper you go into the game; the waves of fireballs, the formation of aliens, the claws in sector three. In fact the more I go back to XR-35 the better I get at Salamander (Hey, I'm not complaining)!

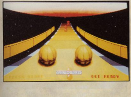
The most amazing thing about XR-35 is the fact that this game is a budget release. There is a lot of game here as well, so the chances are very unlikely that you will play this game from one end to the other. At first though it takes a lot of playing to get even past the first sector, let alone finish all twelve sectors.

At £9.95 for this fast, sideways scrolling shoot 'em up, XR-35 looks to be one of the best value for money games there is for the Amiga. If there was a game of the month for the Amiga, then this would be it! **M.B.**

Touchline:
Name: *XR-35.* ***Supplier:*** *Anco Software, 35 West Hill, Dartford, Kent DA1 2EL.* ***Tel:*** *0322 92513/8.* ***Machine:*** *Amiga 512K.* ***Price:*** *£9.95.*
Originality: *6/10.* ***Graphics:*** *8/10.* ***Playability:*** *6/10.* ***Value:*** *7/10.*

Roadwars

This is the first game I have seen for the Amiga from Melbourne House – and with flashy packaging to accompany this game, it is fairly safe to assume they are back with a bang.



The booklet supplied with the game gives some clap trap about a computer going berserk and you, as ever, having to thwart the rogue machine's attempts at killing you!

All this is utterly unnecessary and gets in the way of a smashing game – the graphics are fast, the animation is reminicent of the good old days of Atary's Pole Position, and the challenge is infuriatingly addictive.

You are a ball (I know it seems hard to imagine it) but inside the ball is a laser gun turret. It is up to you to shoot out the rogue blocks that make up the walls and sides of the road, thereby stopping the electric fence that will blow you up if you go through the blue arcing without your shields up. In order to fire out the blocks in the wall, you have to lower your shields – sneaky huh?

That is essentially all there is to the game other than the fact that it is very hard to play, and therefore very addictive. There are satellites that loom up on the sides to occasionally take pot shots at you with their lasers (you had best shoot these out of the sky) and balls that fly towards you – occasionally turning into missiles!

Forget the story line as it is clearly an afterthought. Roadwars is an addictive game with some good, but unimpressive graphics. It looks pretty much the same on the Atari ST so I think you can see why the graphics aren't being used to the full.

With the occasional "inhabitant" shooting at you from behind, and some simple music, Roadwars is definitely a winner in my book. **M.B.**

Touchline:
Name: *Roadwars.* ***Supplier:*** *Melbourne House, 8-10 Paul Street, London EC2A 4JH.* ***Tel:*** *01-377 8411.* ***Machine:*** *Amiga 512K.* ***Price:*** *£19.95.*
Originality: *8/10.* ***Graphics:*** *8/10.* ***Playability:*** *5/10.* ***Value:*** *8/10.*

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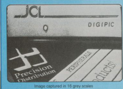

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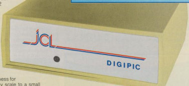

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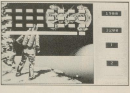
Ball Raider



Question: if you have some excellent screens (either drawn or digitised) for the Amiga but wanted to make some money, how would you do it?

Answer: put a version of Breakout over it and call it Ball Raider!

This is not a quality game. Ball Raider is simply a version of Breakout/Arkanoid/Impact with a pretty series of illustrations to give you a reason for finishing a screen.

The blocks you are supposed to knock away, obscure the painting beneath it, so in order to see the whole screen you have to knock them away!

This is not quality software, it is pretty to look at, but other than that, it is squeezing every last drop out of a well and truly worn out format for a game. That there is a reason to knock those damn blocks out of the way is a first, but I reckon somewhere, someone is rubbing their hands together thinking of all the money they are making out of poor people who have bought this trash.

If you want a version of Breakout, try Impact instead – now there's a game with a challenge. **M.B.**

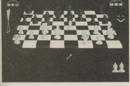
Touchline:
Name: *Ball Raider.* ***Supplier:*** *Robtek Ltd, Unit 4, Isleworth Business Complex, St. Johns Road, Isleworth, Middx TW7 6NL.* ***Tel:*** *01-847 4457.* ***Machine:*** *Amiga.* ***Price:*** *£19.95.*
Originality: *2/10.* ***Graphics:*** *6/10.* ***Playability:*** *3/10.* ***Value:*** *1/10.*

The Art of Chess

As is now customary with computer chess packages, the Art of Chess from SPA features every conceivable gimmick when it comes to offering playing options.

The board can be two or three dimensional. You can rotate it to whatever angle you like. The colours of the board can be changed to suit your mood or interior decoration scheme. The shape of the pieces can be changed and you can even introduce your own designs, providing you have a copy of DeluxePaint to produce them. Other features include a voice commentary and an optional performance meter which claims to show who is winning although it only measures material, not position.

The more I see of these gimmicks, the more I wonder how much they are actually necessary or whether they are just there to cover up deficiencies in the playing side of the program. Who actually uses them? Of course, we all play with them when the program is first loaded in, or we are showing off to our friends. But then what? When it actually comes down to playing a game, I suspect that ninety plus per cent of users opt for the clearest image which is the old fashioned 2-D top down view.



When you actually get down to playing the game, the computer's skill level can be set by adjusting the time it thinks for each move. The slider scale ranges from ten seconds to five minutes but you can opt for a no limit setting in which the Amiga will think for as long as you want it to. One nice idea that I had not previously come across was a second slider control that determines how aggressively your opponent plays.

At any stage of the game, you can check on how a given square is being attacked or defended. You can move backwards and forwards through the moves played so far. There is no hint facility as such but you can always swap sides, see what the Amiga does and then swap back again.

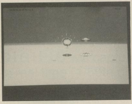
Positions can be set up for problem solving or later examination and games can always be saved. Thirty sample games are included on disk for you to examine at your leisure but there is no commentary saying what was special about them, so beginners are not going to get a great deal from them.

Menu control was not as simple as it should have been; some of the commands were somewhat obscure and the program crashed on me several times.

As far as playing strength goes, the Art of Chess, like all similar programs is difficult to assess as my budget does not stretch to two Amigas to play rival programs against each other. Nor does the (limited) documentation give any details on the size of its opening library or any indication of an approximate rating at different time levels. From a purely personal point of view, I felt that Chessmaster 2000 from Software Toolworks offered me a better game and was much the better presented package. **G.R.H.**

Touchline:
Name: *The Art of Chess.* ***Supplier:*** *SPA, 16B Worcester Place, Oxford OX1 2JW.* ***Tel:*** *0865 54195.* ***Price:*** *£24.95.*
Originality: *8/10.* ***Graphics:*** *8/10.* ***Playability:*** *6/10.* ***Value:*** *6/10.*

Space Ranger



Around the stately parks and gardens of Grace Manor, the theme music for Space Ranger (or "Save the Teddies" as we call it) is forming yet another background for the long winter nights that are slowly drawing to a close. It is another Mastertronic cheapie and is a clever reworking on the old Defender idea, where monsters come down from the sky to steal inhabitants of some unknown world.

The difference is that instead of ships there are monsters; instead of little stick men, there are now animals and creatures, and instead of lots of monsters coming to steal the animals, there is just one "T" shaped edifice that sucks the creatures into itself – relying on the monsters to drag the animals under the space ship.

Your task is to kill all of the monsters but not the animals.

Easy? Don't kid yourself, perhaps I forgot to mention the fact that the space ship and the monsters retaliate, throwing snowballs, spinning stars, fists (!) and all are extremely well animated. At higher levels, the games become harder with more creatures to rescue, more animals to kill or avoid, and so on.

Nice features about this game are the scrolling multi-layer backgrounds, the simple and effective muzak, the great animation, and the Teddies! I'm sorry, but for me the Teddies are a vital part of this game, and rescuing them from the nasty baddies gives me cause for concern, after all what would you do if your teddy was whisked away!

Space Ranger is a very good game – not original, but as it is one of Mastertronics' latest budget priced games, I think I am willing to overlook the matter. Certainly as it stands, the game could do with some improvements – 30 seconds of disk crunching between levels is beginning to really bug me! A shame as there are no real complaints about this nicely presented game. Heck – I even devoted the best part of six cherry cokes while playing the game. A recommendation? I should say so!

My Teddy agrees. **M.B.**

Touchline:
Name: *Space Ranger.* ***Supplier:*** *Mastertronic, 8-10 Paul Street, London EC2.* ***Tel:*** *01-377 6880.* ***Machine:*** *Amiga.* ***Price:*** *£9.95.*
Originality: *6/10.* ***Graphics:*** *8/10.* ***Playability:*** *7/10.* ***Value:*** *8/10.* ***Teddy Value:*** *10/10.*

Backlash

For once I thought I had found it – the perfect game for the Amiga! In an unassuming tacky box with an equally tacky piece of artwork sporting the cover, this game looked to all intents and purposes the prime dingbat game of the month but upon loading it, Backlash won me over completely.

The game is simple – you are driving very fast across a scrolling terrain. There are occasionally small pyramids to stop you driving in one direction forever.

Now we get to the good stuff! There are silos dotted around, and out of these come all sorts of creatures, flying saucers and the like. They shoot missiles at you and your task (of course) is to dodge them and destroy your opponents.

The graphics are excellent. Solid 3D shaped with shadows and very smooth flicker-free movements. The explosions are loud (!) as are most of the sound effects, especially the constant tirade of bouncing bombs that you fire bouncing off into the distance if they don't hit anything.

The waves of opponents naturally get nastier as the game progresses. The screens all change colour to show that you have destroyed one wave, followed by an intermediate wave. Occasionally there is a missile that dodges and serves all attempts at your moving out of the way or blowing it to kingdom come, and it takes skill to shoot it a higher levels.

This would have been the perfect shoot 'em up for the Amiga, had there been a little more variety to the game. As it is, the game gets a little repetitive towards level ten and it is a shame that there aren't aliens to destroy – as it is, there are about ten different types in all.

If you like to marvel at the excellent programming and the great care and attention to detail Novagen have put into this game, and a fast example of what the Amiga can do, then probably the game is for you. Fast graphics, loud and dirty sound effects all make for a good game – a few more features and this would have been perfect. **M.B.**

Touchline:
Name: *Backlash.* ***Supplier:*** *Novagen Software, 142 alcester Road, Birmingham B13 8HS.* ***Machine:*** *Amiga.*
Originality: *9/10.* ***Graphics:*** *8/10.* ***Playability:*** *6/10.* ***Value:*** *7/10.*

Emulator —64—

We take a look at the recently updated 64 Emulator – does it really make sense?

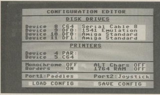
By Gordon Hamlett

The general opinion of someone who has recently upgraded from a Commodore 64 to an Amiga, and who is thinking of downgrading again, is that they are living in fantasy land! But the idea is not as stupid as it first sounds. At least Ready Soft Inc. don't think so.

They have just released the 64 Emulator which allows the user to run their old 64 programs on their Amigas. Well, some of them anyway but more of that anon.

What You Get

The key to know the works of the program lies in the serial interface – a cable that connects the parallel port of an Amiga to a 1541, 1571 or similar disk drive. Amiga 1000 users must ensure that they get the right edge connector (it is slightly different from the 500/2000 model). You will also need Kickstart 1.2 and 512K of memory.



```
CONFIGURATION EDITOR
DISK DRIVES
Device  8 C64   Serial Cable 8
Device  9 DF0:  1541 Emulation
Device 10 DF0:  Amiga Standard
Device 11 DF1:  Amiga Standard
PRINTERS
Device  4 PAR:
Device  5 C64
Monochrome OFF      ALT Chars OFF
Borders    ON       1764 RAM  OFF
Port1:Paddles       Port2:Joystick
 LOAD CONFIG         SAVE CONFIG
```

What You Can Do

The Emulator allows you to use Amiga disks as well as 64 drives. Standard 3½" disks, hard disks and temporary RAM files can be used. It should be noted that to use RAM requires one megabyte of memory and not all hard drives are compatible. Minus points to Ready Soft Inc. for not saying which ones.

The 1020 5¼" disk drive can also be used but you still need a 1541, etc to read the files initially.

Amiga drives may be kept as standard Amiga or toggled to 1541 emulation. Emulation mode restricts the amount of space available on the disk as a standard 1541 disk but is likely to result in higher compatibility. A transfer program is included to help you swap your files over from 5¼" to 3½" disks. Either the entire disk or selected files can be copied although the program may not work if the files are copy protected.

Printers and Amiga modems can be selected in the same way as disk drives, but 64 modems such as the 1650 won't work.

All these instructions are easily changed using a pop-up configuration menu and once you have tailored the system to suit your hardware requirements, your customised configuration can be permanently saved.

Occasionally, there will be conflicts when two peripherals require the same port simultaneously, e.g. the Emulator interface and a parallel printer interface. The software will prompt you for the device that is currently required.

Other items that can be changed from the configurator menu include control devices – joysticks, mice, lightpens and paddles. There is a faster monochrome mode if graphics are unimportant together with an optional improved character set.

What Works

Not every program for the 64 is compatible with the system but by the same token, you wouldn't want to run all your programs this way.

Most utilities will load and run with no trouble at all. Superscript, GEOS, PaperClip and Printshop are all compatible.

Games however are a different proposition with their fast loaders and extra protection devices. Games that I could load include Infocom's titles and Guild of Thieves from Magnetic Scrolls. I can't really see anyone wanting to try anything other than adventures as arcade games both run alot slower (2-5 times) and tend to suffer from some horrible flickering in the graphics, especially when a lot of sprites are close together. The most recent arcade that I could get to load was Lode Runner which was released a couple of years ago. Modern games from US Gold, Electronic games that I had transferred to disk using a Freeze Frame cartridge.

Conclusions

So who would find 64 Emulator useful? Certainly not the games player! However, for anyone who has a lot of word processing or data base files and is wondering whether or not to upgrade either software or machine, the 64 Emulator could just help to tip the decision.

Touchline:
Name: *Emulator 64.* ***Supplier:*** *Robtek Ltd., Isleworth Business Complex, St. Johns Road, Isleworth, Middlesex TW7 6NL.* ***Tel:*** *01-847 4457.* ***Price:*** *£69.95.*

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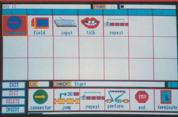


AiRT – a language with a major difference, you don't have to type anything!

By Mary Branscombe

Learning a new programming language can be a time-consuming task. Initially you have to understand the structure of the language, secondly you have to understand the way the program resides in memory – are they large or small programs? Do they run fast or slow, and what are their I/O (input/output) commands? How effective a language is it for specialised tasks such as communications or graphics, and how effective it is for tasks involving the Amiga's intuition operating system enabling other programs to operate at the same time?

AiRT is an interesting alternative to most of the above problems. It is a general purpose language designed for "popcorn" programming – programs that are designed for one particular use and then discarded. In many respects BASIC is an ideal programming language for such applications, but on the Amiga is a complex language requiring a lot of "unlearning" in order to utilise the many new commands Amiga BASIC has to offer.

The difference with AiRT is that it uses pictures. You point at symbols on the screen with a mouse – each symbol represents a function and each function represents a series of commands. There is nothing to type in and, of course, no command structures to forget.

Language Similarities

Programmers will often talk about programming structures. What they mean is how a program is stored in memory, how it is arranged so that it makes logical sense to the programmer and more importantly, how it looks to a programmer just taking over the program. The BASIC programming structure to AiRT is an innovative programming structure called a frame.

Frames are represented on the screen as a square box which are numbered starting from 1 up to 75. Inside each frame are 75 cells; these cells are used to store icons that represent different operations – their equivalents can be found in many modern computer languages, such as BASIC, "C" or Pascal. Instead of having a rigid syntax structure, commands are represented as symbols that can be laid down, one after the other.

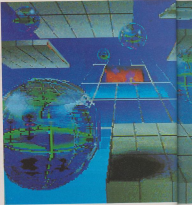
Each cell has a "cell map"; this is a way of telling the programmer what is going on, and where each of the icons

Continued on page 18

The I.M.P. is out of the bottle

In this follow-up article we look at the IFF system as the basis for smooth integration between DigiView, DPaintII and DigiPaint

By Lewis Tilley



When you have grabbed an image or digitised the picture with a TV camera and DigiView, you'll start with two million colours. Yes, two million, two hundred thousand to be exact.

All of these are generated as Raw Data by the hardware/software combination DigiView. Overwhelming, isn't it? No need to worry though, for although the Amiga can't display quite that many, even using HAM (hold and modify), DigiView immediately blends the couple of million down to a manageable four thousand and ninety-six. To prove it to you the software displays two graphs under the title Histogram. One is marked Raw Data. It graphs the two million colours. The other graphs Adjusted Data or the blended down colours.

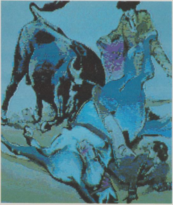
Here is where the Amiga flaunts its superiority over what is presently available in MSDOS on IBM's costing much more. Only with the new CGA and VGA adapters can IBM even approach the greater colour display of the Amiga. With these adapters they can display 256 colours in the 320×200 resolution mode. With DigiView and DigiPaint the Amiga uses HAM to show all 4096 colours in the hi-res mode of 320×400!

Without using HAM, the Amiga (with its highest resolution full-screen of 672×444 and using 16 colours) is wider and slightly less deep than IBM's VGA adapter's hi-res 640×480 and 16 colours.

If you wish to display black and white photographs, DigiView has a special hi-res mode for doing just that and it is done superbly! You will find it tempting, however, to manipulate the photos, swapping heads and bodies of beach snapshots of friends. (This may be dangerous to your health!)

Why not work all the time in DigiPaint with these 4096 colours at your disposal? To be perfectly frank, the painting tools of DigiPaint are better suited to a final manipulation and touch-up of your image. It does much that DPaintII cannot do. It acts like a magic colour glazing brush, adding a little colour here, glazing down a colour which is too bright there. . .even merging and mixing objects and shapes between two pictures.

Continued on page 21



the
tII

are. Naturally there is a "frame map" too. The map shows a grid of the 75 possible frames – the ones being used are highlighted. To use a new frame, you point the mouse at an empty frame and press the mouse button.

The cell map is divided into 25 squares and displays co-ordinate rows 1-3 and columns A to Y. The frame map works in exactly the same way as the cell map, and, as you may imagine, it can store quite a sizable program (exactly 5,625 icons). Therefore you are writing popcorn programs that are longer than AiRT's limit. I would seriously recommend that you start thinking of rewriting the program in another language and turning it into a properly compiled program using suitable alternative language.

Icons for Commands

Icons are used as the equivalent of a command and are stored in the Icon library. When you are creating your program using the AiRT program editor, the Icons are presented on the screen in logical groups.

Pointing the mouse at the relevant cell, and then choosing an Icon from a list will move that Icon into the highlighted cell.

Like all other languages, AiRT needs temporary storage areas, and to this purpose fields are used. Fields are stored in a field map, i.e. there isn't a particular syntax to remember, you just have to make sure that you get the right data in and out of the correct fields. There are a possible total of 1250 fields which, on the surface seems a lot, but they do all eat up memory. You do have the option to use multiple fields in a single function, which is actually quite a powerful facility, and very much like Pascal in its structure (although Pascal isn't as easy as AiRT when it comes to field handling).

After a program has been put together by throwing in a few variables, a few icons and a few jumps here and there, you have a program (regardless of whether it is of any use). In order for the rows of FRAMEs and CELLs to be used as a program, the file has to be compiled in order to make them run as stand-alone programs.

Each AiRT program resides in its own workbench drawer. When the Compiler is invoked, it translates the program into a RUN file (which means that it can be taken off of the AiRT disk and used outside of the AiRT system). If, on the other hand, the AiRT compiler came across a command that didn't make any sense, it would abort the compilation process and make an entry into the AiRT log.

If by the end of the process the file isn't created, then you simply open up the log and look at the last entry to see what went wrong. The system isn't all that friendly I grant you, and it is reminicent of some of the older compilers for Fortran and Pascal and Cobol, but the likelihood of making a stupid mistake isn't very high, if you know what you're doing.

The AiRT Editor

The power and flexibility of a language often rests fairly and squarely on the shoulders of the editor – and with a language such as AiRT, a fairly powerful editor is needed.

The AiRT editor is a graphics orientated picture manipulator that is used to select Icons from the Icon library so that they can be arranged in a logical order within any of the available frames.

The editor resides in the drawer for the program being created or edited. Firstly, you have to open the disk containing the "Point and Click" icon. This will open up the editor file and put you into the frame map (and from there you can create a program, append a program, and delete or load a program).

Programming and Resolving

Once you start using icons for programming, you will come across the "Resolve Decision" screen. This screen is used by AiRT to collect all parameters necessary to resolve the Icon. For example, a cell that uses three or four storage areas needs to be resolved in order to link itself with the storage areas. This is important to remember as compilers, in general, are never strong when it comes to managing memory resident data.

Luckily, such problems do not occur with the AiRT compiler as the structure is remarkably self-contained (as it should be, considering the way programs are designed).

The AiRT Compiler

The power of the AiRT compiler is impressive – there isn't anything I could throw at the compiler that could not be transformed into executable machine code.

Compiling a program does not take a long time, when it is loaded it initially opens a window displaying the version number of the compiler. The compilation process takes just two passes (as far as I can work out). The first pass being a simple check of the syntax, a look at the variables, and a translation of all the fields defined in the program, the second pass is the full compilation.

At all times the compiler is telling you what is going on (which is a good thing) and the code that is produced at the end of the successful compilation executes with no discernable bugs. AiRT programs are not all that small by comparison to equivalent programs written in BASIC, but they are stand-alone and can operate alongside such useful packages as Gizmoz and Workbench without modification or kludging.

In Use

The documentation is awful – it is probably bearable if you are American, but on this side of the pond it is not acceptable. The manual is full of colourful metaphors that are riddled with puns, and to be quite honest, the manual could be better than the slip-bound A4 photocopied sheets that I received.

I have used AiRT for three months now, and I must admit I wasn't too happy about using Icons to write a program. I found the environment annoyingly limited and the programs generated by the system to be so small as to be not worth writing. However after a while, I started writing programs that while they weren't earth shattering, they did save me a lot of time with the workbench, (a "purge buffer utility", and a keyboard tester) and I slowly started to see how useful popcorn programming really was!

I still wouldn't recommend AiRT if you happen to be a dab hand at programming in BASIC, Pascal or "C", but if you bought your Amiga for word processing or just for playing games, and you would like to start making your Amiga work for you, then I would say give it a go.

I'm glad I did!

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DPaintII, on the other hand, is a miraculous workhorse. It gives its owner one of the most creative sets of instruments ever available to the artist. The combination of the two programs seems to enable one to emulate the approaches of artists from the past ranging from the delicate glazes of Titian to the wild impasto swirls of Van Gogh.

In spite of the flicker (which can be tamed considerably with a sheet of grey perspex cut to fit your monitor – or one of the proprietary anti-glare screens such as Suncom's GlareDown12 which fits the Amiga 1080 monitor), many artists prefer the interlaced mode of 300 × 400 in DPaintII. In this mode you have the vertical resolution as the hi-res mode plus the full 32 colours. When you load this mode into DigiView, it slips in with no change of image size or proportion. If you work in hi-res 640 × 400 and bring it into DigiPaint 320 × 400, the 640 is compressed into 320 but some of the 4096 colours make up for the loss of resolution. . .so. . . you have what is effectively a 640×400 hi-res image displaying 4096 plus colours. Yes, 4096 *plus* colours since there are still more colours achieved with a dithering control.

Let it be known that such manipulations don't come cheaply. They eat memory voraciously. *Don't even think of the hi-res modes if you don't have a megabyte tucked away somewhere.* Any more than a megabyte doesn't help due to the way the Amiga 1000 manages its graphics. In addition to the advantages to DPaintII's hi-res, the "spare page" (hit key J) is usually available since it swaps in and out of the megabyte of Fast Ram. When in DPaintII you can check on memory available by hitting CTRL and "A".

To summarise the previous two paragraphs concerning resolution modes and screen swaps between the two programs; you can load any DPaintII image into any DigiPaint and correct for a correctly presented image. . .or distort the DPaintII one for a creative effect. *However*, once into DigiPaint you cannot go back into DPaintII!

Fortunately a new program allows you to do that, and also further manipulation to IFF files. Butcher by Eagle Tree Software, P.O. Box 164, Hopewell, VA 23860 USA (804) 452-0623 is a graphics program for the Amiga designed to complement paint programs, and digitisers reads the blurb on the disk jacket. Butcher also does Edge Mapping, makes a halftone picture of black and white dots, generates unusual colour effects such as positive-negative reversals, complementary colours, false colours, toning, separations, and will enable you to design any shape you desire for displaying a picture as a mosaic of that shape. This mosaic feature makes any Amiga owner an instant stained glass designer. You can also turn your images into needle point or tapestry designs! More sophisticated utilities are included. The program makes histograms of colour register usage, sorts registers, examine bit-planes and many more miracles.

A final tip about DPaintII mode changes. It seems that you can "change up" with a loss in size of the total image, but be careful the way you change a hi-res down to a low-res. By switching numbers of colours in the low-res mode to match or lower than the palette used in hi-res, you can have that hi-res image as a quadruple size image which may be scanned with the arrow keys. Try working on the image in this magnification,then relocate it in hi-res using Screen Format Requester.

Starting an Image

Then where shall you get the images to manipulate? That is where our first tool comes in. It is an image grabber from NewTec called DigiView which will put any two dimensional picture you digitise with a TV camera using their colour wheel RGB filters into an IFF file compatible with most Amiga graphic programs. (The preferred camera with clear instructions on its use are discussed in the new User's Manual supplied by NewTec. An excellent article on the whole system was published by the technical computer magazine Byte in March 1987.) We owe the file standardisation to Electronic Art's development of the file structure called IFF, or Interchange File Format. If you want to read more about IFF structure, Amiga Technical Support offers a manual called The Electronics Arts IFF 85 Manual for $20. You get both documents and a disk. Contact Kim Montgomery, 1200 Wilson Drive, West Chester, PA. 19380 USA.)

New developments by programmers at the World's Biggest Computer Magazine (two pounds, four and three quarters ounces by weight – one hundred thirty cubic inches by volume and called Computer Shopper) have gone even further with interchanging file formats. The October issue contained information on a Public Domain program which will swap images between the Amiga, Atari ST(SS) and MSDOS.

There is also a new program which will interchange objects between Sculpt 3D, Videoscape 3D and Forms in Flight. It is called Interchange and was developed by John Foust who was the Technical Editor of Amazing Computing which is a very good Amiga magazine with a professional slant towards programming. These video programs will have to wait their turn in this series.

Hand Done Images

DigiView has brought photographic imaging to the Amiga user for a reasonable cost. There is, however, the rich world of hand manipulation imaging. The new Summagraphics tablets which have now joined Easyl with Amiga compatible digitising boards, make the transfer from pencil and paper to computer screen drawing simple. Having used a Koala digitising tablet on the Commodore 64 for several years, the mouse on my Amiga was an awkward tool when I first tried to draw freehanded. The high prices of the digitising tablets forced me to stick with the mouse.

Reaction speeds of the mouse can be controlled from Preferences on the Workbench. The surface on which you operate the mouse are also a factor in its control. Try the differences between a polished desktop, a regular rubberised mouse pad and the slight foam texture of some plastics which add friction to the pull of the ball. An occasional cleaning of the mouse ball may be needed. Be sure to follow your manual's instructions accurately.

Much of the work using Digipaint must be done with the commands FILL and MODE menu Shading. You must trace the outline of the area you wish to modify by using the one pixel brush. This brush gets progressively difficult to control as you proceed with the drawing. You may prefer to use short segments of the Straight Line icon drawing tool, clicking LEFT mouse button after each segment to form a continuous contour under a steadier control. The Right Mouse button sets the line.

Since Shading is such a powerful modification tool to bring the richness of 4096 colours to your 320×400 image started in DPaintII, use it fully. When you select Shading, the MENU line will display a thin long box called Dither Control. To its right is the Position Box which displays the position of the greatest density of the colour with which you have chosen to shade. There is a small solid square in the centre when you first activate the feature. Drag it with the LEFT button to the spot where you want the heaviest concentration of the colour. The density will feather out on your image from the spot both horizontally and vertically. If you want shading strictly horizontally or vertically, move over to the directional arrows at the right and click one of them off to reveal a bar inside the Position Box replacing the tiny square. That bar will be either a horizontal or vertical band. Shift it to place your density where you choose.

Hidden in the command AND of Digipaint is a colour separation utility which artists working with autographics (handmade prints, i.e. silkscreen, block prints, lithos and etchings) will find very useful if they want to try three colour printing. The 56 page manual of DigiPaint fully explains the above procedure as well as the operating instructions for the program. NewTec, by hiding the secret password for DigiPaint therein, requires you to keep that manual before you at all times. As with Marauder II, the fine copy program, one must look up a page number, a line and a word in the book to answer the question asked before the protection is lifted. Unlike Marauder, who has gone to a built-into-the-program page, line, word list, NewTec's book must always be consulted.

A Step By Step Procedure

The January *Your Amiga* cover, Space Invaders, was designed on its side to be used as a vertical. I used a tricky technique in DigiPaint to get this one. First, a grid was made with DPaintII and tilted into a perspective which was spiffed-up with the anti-aliasing mode. Then, it was merged from the second place screen of a blended blue and black sky made in the HAM mode of DigiPaint. The little space ships arrived and started firing their rays after I discovered the tricks of blending those pearly glass bubbles. They were drawn with the circle icon and modified with FILL and Shading.

Another hand made image, the Woo Ladies is a blend using RubThhru in DigiPaint. The nude man was digitised from a large charcoal drawing. The ladies were duplicated and modified from a painting of one lady done using the Aegis Paint program. They were loaded to DigiPaint's 320×400 and from SWAP copied to the back spare screen. Using Rub Thru from the menu the ladies were revealed through the black front screen by using the oval icon. Later, in a similar manner, the man was revealed onto the front screen with a free-form use of the large spot brush.

Balloon Landings started as a DPaintII perspective exercise in HIRES using 16 colours. Half of these colours were used in a spread of values for the browns and half for the blues. The range for each was then used to fill the perspective grids. Later, saved and transferred, the 4096 colours of DigiPaint HAM added the fiery colours of the landing pit and the cool colours of the balloons. Note the balloon high lights done with the combination small square density placement of Shading. The enlarged pixels of the balloon with its pixel people in the foreground are purposely enlarged with Butcher to contrast with the tiny pixels of the rest of the distant balloons.

More ways of using these two programs together continue to suggest themselves. If you have any difficulty in understanding some of the more complex operations discussed in the use of DigiPaint and DeluxePaintII may I guide you toward the interactive tutorials published by RGB Video Creations, 2574 PGA Blved., Suite 104, Palm Beach Gardens, Florida 33410. HB Marketing of Feltham, Middlesex, U.K. should be handling them soon. They call the series Deluxehelp and have already published disks for DPaintII, and DigiPaint. Soon to come is DeluxeHelp for Calligrapher. Down-the-road-a-piece, using the same tutorial interaction, will be programs for Pagesetter, Photonpaint and Express Paint. *Your Amiga* will be exploring the last mentioned third generation (post DPaintII) painting programs in the near future.

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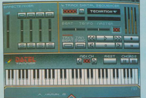

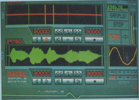

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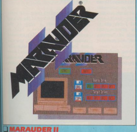

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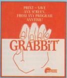

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Sculpt 3D

An innovative graphics package that takes a lot of the hard work out of drawing in perspective

By Mary Branscombe

The Amiga's famed graphics capabilities have always been renowned. All machines in the Amiga range have a number of high resolution modes available, and with a minimum of 512K in modern Amigas, it is not surprising to see a number of really special graphics packages at last becoming available for this powerful machine.

Sulpt 3D is an interesting package in that it is not a purely art based package, neither is it a typical design package (for example CAD). Sculpt 3D enables the user to draw on the screen in freehand, but in any one of three projections (as is common with technical drawings). It just about allows photographic control over the rendered image, by positioning "lamps" at certain places (either on or off the screen) thus generating literally thousands, perhaps millions, of possible shades and depth changes.

What is Sculpt 3D?

Sculpt 3D can best be described as an interactive solid modelling editor, combined with ray tracing software to generate very realistic images on the screen. This means that Sculpt 3D can be used to construct a computer simulation of any solid shape you care to imagine. There isn't any conventional parallel I can use to explain the design process, but something in the vein of "carving shapes out of solid air" will probably do.

Details are something Sculpt 3D takes care of quite well – shades, shadows and perspectives are all handled by the editor. Because the drawing is created on a three screen "board" on the screen, painting a picture must be methodical and planned – you will have to work out things such as depth and angles for yourself, but hidden line removal and perspectives can all be handled.

First Steps

The most important thing is to make sure you have a backup of the disk up and running with a copy of the Workbench. If you have a 512K in order to reach Sculpt 3D's unstated minimum of one Megabyte, you can use Sculpt with a 512K Amiga (for example, a basic Amiga 500) as I have done, but rendering images, drawing screens and using the high resolution

modes are made much simpler when using this package on an Amiga with the one Megabyte upgrade. A dual drive is also a boon as there is some disk swapping from time to time.

Once you have booted up the disk and you are inside the first level of Sculpt 3D, you are presented with three windows, which is called "Tri View". This is a necessity as a computer can only represent images as 3D on a flat 2D screen. In order to actually draw in 3D, you need to display images in orthographic projection, hence the Tri Viewer's approach of front, sides and top view that form part of the complete image.

Each window has a series of gadgets that are used to reposition the image in each view, each window has a blue cross, and within each window you can zoom in or out of a picture thus rescaling the image to your own size. Naturally all windows can be resized to accommodate larger or more detailed drawings as and when necessary.

If you have enough money, (i.e. one Megabyte or more), you can run other packages at the same time. Sculpt 3D supports the Amiga "Intuition" multitasking environment, so it is possible to run a wordprocessor or a few tools from the workbench or any other desktop alongside Sculpt 3D. I have found that it is a good idea to have the "Notepad" and a "calculator" in the RAM disk as you draw.

A word of warning though, Sculpt 3D is not fast. Because of the very complex drawing calculations being performed, running a wordprocessor at the same time as Sculpt 3D will slow things down even more than normal. A standard ray trace of a conical pyramid (i.e. a simple object) will take a few minutes to compute, but with something a little more complex (like the famous byte by byte juggling man demo) these can take literally days per frame.

However, if you have had any experience of technical drawing, then you will find Sculpt 3D's approach delightfully simple.

Menu Operations

Most of the commands issued to Sculpt 3D are made through the use of icons, windows and pulldown menus. To make the menus visible, press the right hand mouse button down and hold it down. The menus show up (typically enough) as a bar along the top of the screen as PROJECT, EDIT, TOOLS, OBSERVER, and WORLD. To see more of the menu choices you move the pointer over the word in the same way you would by operating Workbench.

Probably the first thing you will want to do is load in a picture that is ready made for you to play with. Sculpt 3D has a few, but not many, and the few that are supplied on the master disk are very simple examples of how to design simple objects like the coffee cup or the small house.

A "scene" consists of separate entities such as "lamps", "observer", "world" and "objects". You can load in all of these or only one of them if you like – personally at this stage it is good to load in all items bar the "lamps" information. Try and experiment with single light sources to see how effective the shadowing system really is!

It is now possible to go to the Tri View and have a look at the complete image of the house. By altering your position and relative distance to the house, you can walk around it, and even go inside the house – with a little care!

The backgrounds are interesting in that Sculpt 3D actually draws shadows in perspective, but should you want the idea of perspective made really clear, you could always use the checkered pattern supplied (as part of the package) as a floor or even as a "sky". Some really weird effects can be achieved by using both with mutually opposing checkered patterns, so they meet up somewhere on the horizon – it'll screw up your retinas, but what a nice way to go!

The concept of having a "sky" on the screen is an interesting one, in that it is a horizon bisecting the screen somewhere in the middle. This can be altered so that the line appears more or less anywhere on the screen so the eventual surroundings are very spacious to begin with.

Of the supplied "tools" Sculpt 3D has for drawing, there are many for distorting basic shapes, so, for example it is very easy to create lovely rolling hills on a surface by creating a "disk" (a circle with no depth) and then rip up a few chinks of "earth" by pulling it out with a "magnet". This has the advantage of making shapes very natural, and if you want undulating shapes (perhaps for the features of a face) then this is a very useful tool. However be warned – this is probably the most memory greedy and time consuming task you can give to Sculpt 3D to calculate.

Naturally there are other tools that enable you to distort shapes. Out of the other gadgets, the most interesting is the facility to naturally curve a shape (ideal for rounding off ends) and for extruding (similar to the magnet – but this time the "extrude" tool first performs a fill operation, if possible, and then duplicates the selected object and then links the duplicated and the selected object). For these operations the "dragger" is used in one or more of the Tri View windows so that you can create tubes, poles, blocks or any upright or flat regular shape. Even a high-rise block can be made from an extruded slab.

But the shape distortion tools are not all that Sculpt 3D has to offer. The Observer tools are also very useful because they can alter the overall image – as if you were looking at the whole picture and not just specific items (as you are doing when just using tools). The Observer Painting Mode sets the observer to paint mode thereby enabling you to cover a face with a single colour without using shading or depth effects.

In this mode, shadows are not rendered. Because Sculpt 3D has to calculate the effects of these on the ray trace, leaving out shadows (at the initial design phase) is a quick way of producing an image after its wire frame draft.

Snapshot Observer Mode sets the observer in a mode which creates a ray-traced image which excludes the effect of shadows. The time taken to produce an image is proportional to the image size, so small images can be produced much quickly than larger images. This is something to bear in mind when drawing out an image – do you want a large image full of detail that takes five minutes (and probably longer) to compute, or do you just want the general picture (thereby cutting the compute time down to a quarter.

On the Amiga there are different modes that enable the user to specify different resolutions for different applictions. While the High Resolution mode (600 × 600) utilises the best Amiga graphics, some very impressive effects can be rendered using the Low Resolution modes – if HAM Graphics are used, they are displayed in low resolution mode.

Sculpt 3D gives you full control over the screen interlace. There is adequate support for adding bit planes with any screen mode – adding bit planes means that the number of colours you select are raised by the number of the power of your bit planes. So if you are using a bit plane number of greater than 12, then Sculpt 3D will give you the option of saving an RGB file; 0 is the default state.

Using Sculpt 3D

This is a very impressive package and although it is not easy to use, it is certainly worth sitting down for a month or so and really getting to grips with the complete package.

I would not really recommend using the package with a 512K Amiga – a megabyte is a necessity should you want to start drawing more complex shapes and patterns using the higher resolution modes and the HAM mode.

Sculpt 3D is an innovative drawing package which, for once, actually enables the user to draw very impressive pictures with a reasonable perspective calculation system and a very impressive and easy to use shadowing system. The sad thing is that the Ray Tracing computation time takes so long!

Ray Tracing is an innovative and fairly new idea; you do need a lot of memory and processing power and the time required to generate just one simple ray trace is phenomenal, so be prepared to wait around for a few hours if you are drawing complex images consisting of many elements. Small wonder why the package is supplied with a "caution Ray Tracing in Progress" card to put on your keyboard while the machine is calculating your picture.

I have been using Sculpt 3D for over four months now. Initially my attempts at drawing were pathetic. The concept of Ray Tracing was new to me, and I must admit the whole idea dazed me. After all, a drawing package with isometric calculation, shadowing, perspective, rotational and a spacial distortion system seemed too good to be true. Certainly I have never come across these facilities on a sub-£1000 system – a DEC workstation perhaps (you know those lovely ones that support GPX...) but not an Amiga 1000.

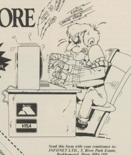
My only gripe is the sluggish way the package responds to calculations, and I know this is because the Amiga has "Intuition" and all the other software tools up and running, but it is very slow. I am playing around with the 68020 maths processor instead of the 68000 in an attempt at speeding things up and I will get back to you when something more coherent comes up.

Anyway, if you just want something to paint with, then do not go for this package. It will not have anything additional to offer than DeluxePaint or DigiPaint which can be bought at considerably lower cost. Drawing in 3D requires consideration and plenty of planning, but if you're looking for the very best in 3D art packages, Sculpt 3D is certainly worth recommending.

Touchline:

Name: *Sculpt 3D.* ***Machine:*** *Amiga 512K.* ***Supplier:*** *Byte By Byte, Arboretum Plaza II, 9442 Capital of Texas Highway North, Suite 150, Austin, TX 78759.*

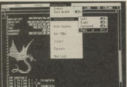
In the UK: *The Amiga Centre Scotland, 4 Heart Street Lane, Edinburgh, Scotland EH1 3RM.* ***Tel:*** *031-557 4242.*



Abacus

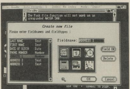
We take an in-depth look at a word processor and a database from Abacus

By Gordon Hamlett



Superscript: ABCDEFGHIJKLMN
Subscript: ABCDEFGHIJKLMN
Elite: ABCDEFGHIJKLM
Pica: ABCDEFGHIJK
Condensed: ABCDE
Expanded: ABCDEFGHIJKLMN

Line spacing:
Line 1 to Line 2 = 1 (single)
Line 2 to Line 3 = 1.5
Line 3 to Line 4 = 2 (double)



File: ReadMe Data records: 3 Index: No index Mode: "Input"

The Pack file function will not work on an unexpanded AMIGA 500.

Create new file

Please enter fieldnames and fieldtypes :

Fieldname: ADDRESS 1

LAST NAME	Text
FIRST NAME	Text
DATE OF BIRTH	Date
PHONE NUMBER	Number
ADDRESS 1	Number
ADDRESS 2	Text
ADDRESS 3	Text

Use the * symbol to page.

Abacus have released two packages which can usefully be reviewed side by side. TextPro is a wordprocessor and DataRetrieve a database. The UK price was not available at the time of going to press but the US price for each package is $79.95.

Textpro

One of the worst things about being a writer is when somebody gives you a blank piece of paper and says *write*. Modern technology has replaced the paper with a blank screen but the feeling of helplessness still remains. I thought that nothing could be worse than this emptiness but on first loading TextPro, I was in for something of a shock. The first thing you are asked is how many pages you intend to write. It is bad enough not knowing what you are going to write about without being asked how much! All creative ideas flew straight out of the window.

Because the Amiga can run several programs simultaneously, TextPro needs to know how much memory to reserve for your work. Logical I suppose but somewhat unnerving all the same. In practice, you can just hit the default unless you are likely to be doing anything unusual.

There are all the usual features found in wordprocessors. The packaging makes a great play of professional features such as justification, headers and footers, bold and italic scripts etc., etc. but I would be very disappointed if any WP package in this price range did not include them.

All these features can be controlled either from pull down menus or via the keyboard. There are four main menus – file, edit, style and formatting. The menus worked well and were largely self-explanatory so that flicking through the instruction manual was kept to a minimum. Good points for simplicity.

Missing Features

There were a number of features missing that I would have liked to see included and some quirks among those that were. As a journalist, lack of a wordcount was immediately apparent. There was also no facility to link files together when printing so that each chapter of your novel must be run off individually. There is no spelling checker which may be bad news for some people, especially as it seems that spelling is no longer taught in schools.

Quirks include the automatic hyphenation – I found that I had to go back and make too many corrections – and I would prefer that this was set to off rather than on, initially. The search and replace function only highlighted the first letter of the word or phrase rather than the whole thing. On one occasion, the word I was looking for was hidden under the requester box asking me if I wanted to look for the next occurrence. As I couldn't see the current one ... These are just quirks though. It all depends on what you are used to.

TextPro supports a wide range of printers and there are facilities to set up your own control characters if yours is not on the list given.

Another feature that some might find useful is the ability to include graphics in the text. A copy of the utility BTSnap is included with the package. Graphics can be inserted into the text or overlayed onto the text.

At first glance, the documentation looks very slick; a 120 page perfect bound manual. The blurb claims that you get a complete tutorial in how to use the package but the reality is that the book is little more than a description of the various features with very little rhyme or reason as far as structure goes.

I showed the manual to two people, one with no WP experience at all and the other a professional secretary. Both complained that it was a total hotch potch and very off putting.

This is one area which companies could put a lot more effort into. A package like this, which is presumably aimed at the lower end of the market is going to attract a lot of people who are new to wordprocessing. The manual is their life line and it would be of great benefit to have something that is written in a non-technical way, preferably with an example document or two and a series of exercises to work through that introduce the different facilities in a logical manner – a few at a time.

Another necessity must surely be a pull-out reference card detailing all the various commands. Not everybody uses the menus and it is a pain to have to keep trying to find what you want in the manual.

To sum up, TextPro is a simple to use wordprocessor, suitable for beginners but marred by poor documentation. Experienced users will probably prefer something with a bit more meat to it though and will find that it is not powerful enough for their requirements.

Data Retrieve

Whereas TextPro was very simple to use, DataRetrieve goes to the opposite extreme. I found it to be user unfriendly throughout and never really came to grips with it at all – a combination of the program and the documentation which is considerably worse than the manual for TextPro.

The packaging starts off by claiming how fast the program is. this sounds impressive until you turn to page three of the manual where it apologises for being so slow compared to other programs. This is because every record in your database is disk based rather than memory based. This has the advantage of being a safer method, but fast, it sure ain't.

The main feature that you have to come to terms with when using DataRetrieve is that of masking. The mask is a template that you tailor to your own requirements. Only information that appears in the 'slots' that you have created is displayed rather than the complete record. For example, suppose you are running a mail order business and want to print off some address labels to send out catalogues to your existing customers. The only part of each customer's record that you are interested in is their name and address, so you mask off all the details of past purchases, etc.

Your database can be password protected for either user or operator. User stops unauthorised access to database while operator stops anyone amending it.

Fields can be one of six types – text, date, time, number, graphic or choice, i.e. specific answers only. One thing I particularly didn't like about setting up choice fields was that when it came to entering data, a typing error would default to the last choice rather than reprompting for a correct entry. For example, suppose you wanted a choice A, B or C. You set up your choice field to accept a/A/b/B/c/C. Now when you are entering your data, you intend to press the 'A' key but accidentally hit the 'S' key next to it on the keyboard. The entry will actually read 'C' which is not what you wanted and requires you to check everything you enter very carefully. A warning beep and a refusal to move onto the next field until a correct key is pressed would be much better.

Searching your database can be decidedly tedious, especially if it is a long one so you will need to set up an index or multiple index e.g. sort by last name, first initial, second initial.

On screen establishment of records and masks was confusing to the extreme and not something that can be tackled without considerable reference to the manual which brings me nicely to my bête noire – the documentation.

Dubious Documentation

Horrendous was the first word to spring to mind. The manual was little more than a description of what each function was for, poorly structured and highly technical. A first time database user would stand very little chance of coming to terms with this package without considerable effort on his or her part and not a little technical knowledge.

It is not good enough to say here are the tools, now go away and use them. You have to be shown how to use them. Up to eight databases can be open at any given time. Fair enough but why would anyone want to do it. A few examples would not go amiss. Sample records and masks for various uses would be a great help. Again, why is there no reference card of all the various commands.

One example that highlights this user unfriendliness especially can be found on the accompanying packaging. "You can exchange data with TextPro... to easily produce mailing lists etc". This is one of the commonest uses of a database yet scouring the indexes of both manuals gave no clue as to where I might find information on how to do this. Scouring the manuals themselves proved to be little better until eventually, I found this reference. It was in the glossary under 'form letter' and the entry read: "Several text editors allow you to produce form letters.... If you've created an address file using DataRetrieve, you can write the file to disk so that you can see the file for text editing." That is the sum total of what you are told. The TextPro manual has no entry for form letters whatsoever. Still, at least I know that I can do it, I just don't know how!

I found little in DataRetrieve to recommend. People who have some strange fetish about databases may enjoy it but anyone who has bought their Amiga expecting that all software will be user friendly to the nth degree should give this package a very wide berth indeed.

Touchline:
Abacus: *5370 52nd Street South East,*
Grand Rapids, Mitchegen 49508 U.S.A.

Adventure Kit V

By Allen Webb

In the final article of the series we look at the final pieces of code and summarise the package

In previous articles dealing with exits and objects, options were provided to allow you to display text in a specific window. The allows you to give information in a clear manner rather than use a scrolling screen. The first piece of code allows the easy manipulation of screen windows. The code occupies the block of memory from $C300 to $C55B and has one entry point. The window position is specified by four parameters:

XC – the X or horizontal coordinate of the top left corner of the window. It's value can range from 0 to 38
YC – the Y or vertical coordinate of the top left corner of the window. It's value can range from 0 to 23
WI – the width of the window (1 to 40)
HI – the height of the window (1 to 25)

As usual, I have not included any data verification routines and you should ensure that the following inequalities are fulfilled:

0<= XC<= 39
0<= YC<= 24
XC + WI <= 40
YC + HI <= 25

The syntax of the commands is as follows:

Scroll window up: SYS 49920,1,XC,YC,WI,HI

Both the character and colour information are scrolled up. The top line of information is lost and the bottom line is filled with spaces.

Scroll window down: SYS 49920,2,XC,YC,WI,HI

This is essentially the same as scroll up except, of course, for the direction of action.

Invert screen: SYS 49920,3,XC,YC,WI,HI

This flips the top hit of each screen code in the window. In the same way as the cusor acts, calling the routine again restores the screen contents.

Fill window: SYS 49920,4,XC,YC,WI,HI,CHAR,COLOUR

This fills the window with the specified character (POKE value) and the specified colour.

Erase window: SYS 49920,5,XC,YC,WI,HI

This clears the window and sets it to the current cursor colour.

With these five simple tools, you can perform a wide range of useful actions on the screen contents.

Up to now we have dealt with the bare mechanics of the adventure such as well defined actions and movement. If that were the sum total of the game, things would be very boring indeed. The things which help set the atmosphere of an adventure are random and semi-random events. In BASIC there are several ways of generating such events:

1. You can use the random number generator to initiate events. By using the internal seed to create a fixed sequence, a predictable series of events can be used.
2. A simple counter in the main program loop can be used to generate regular time independent events.
3. The internal clock can be used to create time dependent events.

The drawback with the timer is that there is only one. To overcome this limitation the second piece of code provides you with eight independent even timers.

The system centres on an interrupt driven routine which counts elapsed time one second at a time. This timer is linked to eight counters which are used

to verify whether an event has occured. Before describing how to use the system, it will be useful if I tell you how it works.

Each event timer has four values, each being in a table. These are:

1. A counter
2. A flag. A zero value means that the timer is off, a non zero value means that the timer is active.
3. An interval value
4. A register.

Each time a second elapses, the timer increments each counter. Each event counter is checked in turn to establish whether the event's interval has elapsed. If the interval has not elapsed, the next event timer is checked. If the interval has elapsed, one of three routines is executed, depending on the event timer concerned. These routines alter the register related to the event timer and may also zero the event's counter. You then act according to the value in the register.

Three types of timer are provided:

Count up – each time the interval is reached, the register is incremented by one and the timer is zeroed. Event timers 0 to 3 are of this type.

Count down – each time the interval is reached, the register is decremented by one and the timer is zeroed. Event timers 4 and 5 are of this type.

Zeroing – when the interval is reached, the register is zeroed. Since this is a one shot timer, the timer is not zeroed. Event timers 6 and 7 are of this type.

The code occupies the area $C600–$C6DC. The event tables occupy the following areas:

Timer table:	$C700-$C707
Flag table:	$C708–$C70F
Interval table:	$C719–$C717
Register table:	$C718–$C71F

To access the tables, given a timer T where T has a value from 1 to 8, use:

Timer Table:	5094+T
FLAG table:	50951+T
Interval table:	50953+T
Register table:	50967+T

Event timer 0 uses the first value in each table, timer 1 uses the second and so on.

There are four entry points:

SYS 50688: This turns on the main timer. This need usually be performed once during the program, unless you wish to access a disk drive.

SYS 50691: This turns off the main timer. You should call this before using disk access.

SYS 50694, TIMER, INTERVAL: This turns on the specified timer and sets it's interval. (1 to 255 seconds)

SYS 50697, TIMER: This turns off the specified timer.

The count up and count down registers allow you to count up to 255 intervals of 255 seconds. This gives a range from a second to roughly 18 hours. The zero timers give a range from one to 255 seconds.

Here are three examples of how to use the package:

- Imagine that you want a magic potion to last for 60 seconds and while it is active, a flag FL has a value of one. The easy way to do this is with a single shot "zero" timer. The following code would do this:

```
SYS 50688: SYS 50694,6,60: POKE
50974,1: FL=1
IF PEEK(50974)=0 THEN FL=0:
SYS 50694,6
```

The first line starts the timer, sets timer six to a 60 second interval and starts it, sets the register for timer six to one and sets FL. The second line checks the register for timer six to see if 60 seconds have elapsed. If the time has elapsed, the timer is turned off and FL set to zero.

- Suppose that you want the hero's strength to decrease by one every two minutes and he dies when it reaches zero. We use a decrementing timer:

```
SYS 50694,4,120: POKE 50972,ST :
                :
                :
IF PEEK (50972)=0 THEN SYS
50697,4: PRINT"YOU ARE DEAD"
```

ST is the starting strength of the character.

- Imagine that you want day and night to occur and change every 60 minutes. A flag DAY is zero at night and equal to 1 at day.

60 minutes = 3600 seconds

If we use an interval of 200 seconds, this gives a maximum register value of 3600/200 or 18.

```
SYS 50694,0,200: POKE 50968,0:
DAY=1
                :
                :
IF PEEK 50968=18 THEN POKE
50968,0: DAY = ABS (1+(DAY=1))
```

The first line sets things going using timer 0. The second line checks to see if 3600 seconds have elapsed. If this time has elapsed, the register is zeroed and DAY toggled. Since this is a continuing operation, the event timer is left running.

That's all the code dealt with. It may be of value if we review the package. The memory occupied by the full package is shown in Table 1

Table 1 — Memory occupied

Parser code	$7000-$74B2	28672-29874
Verb table	$7500-$78FF	29952-30975
Noun table	$7900-$7CFF	30976-31999
Adjective table	$7D00-$7Dff	32000-32255
Adverb table	$7E00-7EFF	32256-32511
Object table	$8000$87FF	32768-34815
Location code	$9000-$92FF	36864-37631
Direction tables	$9300-$93FF	37632-37887
	$9400-$94FF	37888-38143
Destination table	$9500-$9F00	38144-40704
Lower text area	$A000-$BFFF	40960-49151
Objects code	$C000-$C2DO	49152-49872
Window code	$C300-$C55B	49920-50523
Timer code	$C600-$C6DC	50688-50908
Timer tables	$C700-$C71F	50944-50975
Text code	$CB00-$CBFF	51968-52223
Text tables	$CC00-$CFFF	52224-53247
Upper text area	$E000-$FFF	57344-65535

If you want to use your own machine code or set up data tables, you can use the following areas:

$8800-$8FFF (34816-36863)
$C800-$CAFF (51200-51967)

Since the code encroaches into memory usually used by BASIC, you must remember to tweak the top of memory pointer. You can do this by using the following line at the start of your program:

```
POKE: 56,112: CLR
```

The code makes extensive use of the memory areas $02A7-$02FF (679-767) and $033C-$03FB (828-1019) so take care not to use these areas.

That pretty well covers things for this time. In the conclusion I will provide a simple adventure which will show you how to load data and use the routines.

C128 FKeys Swapper

Store four sets of function key definitions with this handy utility

By John Younie

Isn't it nice to be able to define the function keys on the C128 to carry out standard commands? I used to have five or six short programs that did just that. However when using different ones I had to save whatever I was working on and then load the key program that I wanted and then reload the original program, which can be very tedious after a while.

Flipping through the chapter in the Programmer's Reference Guide on the Kernal routines I noticed $FF65 PFKEY;program a function key. Having fiddled with Machine Code for a while I decided to give it a go. The registers used by the PFKEY routine are: A.pointer to string address (lo/hi/bank) for which I used $FA,$FB and $Fc,$FA being stored in the accumulator;Y.length of string to be assigned to the key and X.the key number (1 to 10),9 being the run stop key and 10 the help key. The values for X and Y I stored above the machine code that does the swap – more on that later.

For those of you who don't want to know the ins and outs of the program just type in the basic loader and DSAVE it before running it as it will update itself if the checksum is correct. It will also BSAVE a binary file called FKEYS M/CODE to disk. If you use the basic loader the help key is already set up for swapping between the four sets of definitions, the other keys are as normal. Press the HELP key and a SYS 4864 will be carried out setting the Fkeys to the disk keys set. Type KEY <return> to see what the keys 1-8 are set to.

Most of the keywords are abbreviated to save space and the functions are as follows:

F1: Prints RUN+esc k (end of current line)+move cursor 3 spaces left+esc (clear screen from cursor to end+<return>
F2: Same as above but DLOADS file selected
F3: SCNCLR and DIRECTORY
F4: RENUMBER+<RETURN>
F5: Prints DSAVE"+cursor down four lines and back to beginning of line+print DVERIFY"+up to start of DSAVE to wait for file name. Once file is saved the cursor ends up on the D of DVERIFY. Enter the filename after the " and press return
F6: BLOADS a file as per F2
F7: SCNCLR and LIST
F8: Prints SCRATCH+as per F1 esc k onwards. Answer Y to scratch,N not to
F9: Normal SHIFT/RUN STOP
F10: Carries out an SYS 5091 for Keypad keys

The keypad Fkeys are set up as follows:

F1: Prints PRINT.
F2: As per Disk F2.
F3: Prints *
F4: SCNLR and DIRECTORY.
F5: Prints/
F6: Carries out an AUTO10.
F7: Prints DATA.
F8: SCNLR and LIST.
F9: As per disk F9
F10: Carries out SYS 5323 for the Hexkeys to be set up.

The full stop on the keypad is set up to be a comma for ease of entering DATA.

The Hexkey definitions are as follows:

F1: Prints A
F2: As per disk F2
F3: Prints B
F4: SCNCLR and DIRECTORY
F4: Prints C
F6: Prints PRINTDEC(" ")and positions the cursor after the first "ready for a hex number to be input and return to be pressed to give the decimal value.
F7: Prints D
F8: Prints PRINTHEX$ ( ) and positions the cursor after the (to convert a decimal number into hex. If

the number is less than four digits there is no need to close the closed bracket up, just press return.

F9: As per disk F9
F10: Carries out an SYS 5558 to set up the Normal Fkeys.

The full stop on the keypad is set up as a comma, the plus will print E and the minus will print F.

The Normal Keys are set up as default on power up except the F9 (SHIFT/RUNSTOP). Pressing F9 will carry out an SYS 4864 to return the definitions to the Disk keys.

To use the RUN,DLOAD,BLOAD and SCRATCH keys, press F3 to bring up the directory and run the cursor up to the file you want to load or scratch. Press the key for the function you want and the command string will be carried out without having to shift the cursor across to delete the file type. This makes these one stroke commands.

If you use the Basic loader always reset the computer before loading and running the program otherwise if you have altered any of the FKeys the help key when pressed will contain garbage. If you use the Machine Code file created by the basic loader then start it up with SYS 4864. You can load a Machine Code file over the top of a basic program without disturbing it as long as they don't occupy the same memory but the basic loader will replace the basic program in memory.

The actual program sits in memory from $1300 (4864) to $17A4 (6052). The lengths of the strings are stored at the following locations:

Disk Keys
– $16D5 to $16DE (5845 to 5854)
Keypad Keys
– $16DF to $16E8 (5855 to 5864)
Hexpad Keys
– $16E9 to $16F2 (5865 to 5874)
Normal Keys
– $16F3 to $16FC (5875 to 5884)

The FKey Strings are stored from:

Definitions –
$16FD to $17A4 (5885 to 6052)

On my disk the basic DATA took up 23 blocks and the FKeys M/code took up five blocks.

If you do change any of the definitions to suit yourself, remember to change the string length and the lo/high/bank that are stored in zero page. When the Keypad and Hexpad routine change the keys the characters are stored fron $1B00 (6912) to $1B58 (7000) so don't use this area.

One point to remember is because I use 80 columns most of the time, at the start of each swap routine the computer is put into FAST and at the end is put into SLOW. On the 40 column screen it causes the screen to flash quickly, however I don't think this will bother anyone unduly. If it does then type in the following lines:

```
125 REM **REPLACE 255 with 252
TO CANCEL FAST**
126 POKE 4865,252:POKE
5092,252:POKE 5324,252:POKE
5592,252
```

If anyone wants to learn Machine Code on the C128 I can recommend 128 Machine Language for Beginners by Richard Mansfield. This is a COMPUTE! Books publication and the Label Assembler in the back is well worth typing in – it makes it almost as easy as writing basic programs. YC

See listing on page 100

Software for Sale

If you think that one of our programs looks very interesting, but you can't afford the time to type it in then our software service will help you out

It's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how long you look or how many people help you, you can usually guarantee that at least one little bug slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

INFONET LTD, 5 River Park Estate, Berkhamsted, Herts
HP4 1HL.
Tel: (04427) 76661

Please contact this address for prices and availability.

The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

📼

This symbol means that the program is available on cassette.

💾

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

NOVEMBER 1987

ADVENTURE KIT II — The second part of our C64 adventure writing kit.
KERNAL II — A pull-down menu system giving easy file handling. (C64)
FUNCTION KEY TEMPLATE — Use the Commodore plotter to produce templates on your C64.
PLUS/4 AND C16 DISK MENU — Access your disk files with ease (disk only).
128 PREFERENCES — Predefine your computer's default characteristics.
NUMBER TUMBLE — A frustrating game for the C64.

ORDER CODE
DISK YDNOV87 £6.00
TAPE YCNOV87 £4.00

DECEMBER 1987

DISKIT 8 — A memory clear routine for use with our Turbo, Cruncher from March 1987 (Disk only).
DISK MANAGER — Pop-Up disk commands at your fingertips (C64, disk only).
RELOCATOR — Alter the load address of your programs (C64).
8 SPEED SCROLL — Powerful machine code scroll routine (C64).
TYPRO — A Plus/4 text editor (Disk only).
EASY COUNT — A word count facility for Easy Script users.
BUDGET CALC — Keep track of your finances (C64, disk only).
SPRITE LIBRARY — The first part of our sprite collection (C64).
LISTER 128 — Produce neat C128 listing with this program (C128, disk only).
TRACK/SECTOR EDITOR — A powerful disk editor (C64,

Continued on page 88

THE MPS803

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AT LAST

Top quality performance from your MPS803 Printer. Simply fit 'PRINTKIT IV' directly to your MPS803 printer and you will get:

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`*UNDERLINING` `*ITALICS`

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GEODEBUGGER allows you to toggle between the hi-res GEOS application screen and a text mode debugging screen. Recognises over 80 commands for assembling, dissaembling, single-stepping, setting break points etc. The manula contains over 400 pages of documentation and source code for 3 GEOS applications. An ideal learningenvironment for assembly language.

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---

128 SOFTWARE

Problems With Your Disk Drive?

1571/1541 Drive Alignment by Free Spirit Software reports the alignment condition of the disk drive as you perform adjustments. On screen help is available while the program is running. Includes features for speed and head stop adjustment. Allows you to test each full and half track as you re-align the drive. Complete instruction manual on aligning both 1571 and 1541 drives. Even includes instructions on how to load the alignment program when nothing else will load! Works on the C64, SX64, 128 either 64 or 128 mode. **Price only £24.95.**

New Commodore Version 5 ROM.

Are you experiencing any of the following problems with your 1571 disk drive:-

- Errors when using Superbase?
- Device Not Present errors?
- Major problems when 2 or more open files?
- Takes forever to recognize a flippy disk?

If you have one or more of these problems then you need 1571 FIX ROM, developed by Commodore Inc, USA, do not settle for cheap alternatives, just plugs in, solves over 19 main problems, **only £24.95.**

New 3 1/2 Disk Drives.

The new commodore 1581 1 megabyte disk drive is now available for the C128 or C64. This drive has been designed for large data users, it offers 3,160 blocks free, 8,000 bytes per second (31 blocks) loading rate. Software for this drive includes CADPAK, CHARTPAK, Oxford Pascal, Hackpack, Petspeed, GEOS, etc. Using the CANNON or Super 81 Utilities most software can simply be copied to the 3 1/2" disks. The drive is available for **only £199.95.**

Catalogue Those Disks!

Disk Librarian will catalogue upto 1,000 disks and 15,200 programs into seven categories, games, archival, education, communications, productivity, CP/M and Utilities. Printer reports include library index, full library report, master program list, category program list and Dir labels. Includes ultra-fast search and sort capabilities. Super Disk Librarian 128 **only £29.95.** C64 version **£19.95.**

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We are proud to introduce Basic 8 with Basic 8 Paint, Basic 8 Calc and Basic 8 Write. Basic 8 is the first 128 software package specifically designed to unleash the hidden graphics power of your 128. Using a special wedge technique, Basic 8 achieves performance rivaling that of 16 bit micros! Imagine your 128 in 80 columns producing a resolution of 640 x 200 in mono and 640 x 192 in 16 colours without additional hardware!

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DIR COVER — Produce your own detailed disk sleeves (C64 plus disk and printer).

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JANUARY 1988

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FEBRUARY 1988

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MARCH 1988

LABEL LINKER – Create a library of C128 programs (C128 disk only).

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ORDER CODE
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Cassettes or disks are available from March 1986. Please ring the editorial office (01-437 0626) for details of these.

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☐ Some knowledge of M/C is helpful – but full instruction are provided.

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☐ Alternative character set ROM – fitted in seconds.

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"For anyone who uses their printer often this chip is a must. It's quick and easy to use and the end results are impressive" – Your Commodore, Jan 87.

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Turbo Rom II is a replacement for the actual kernal inside your 64. It provides superfast load/save routines.

☐ Loads most programs at 5-6 times normal speed.

☐ Saves at 5-6 times normal.

☐ Improved DOS support including 10 sec format.

☐ Programmed function keys:- load, directory, old, etc.

☐ Return to normal kernal at flick of a switch.

☐ FCOPY – 250 block file copier.

☐ FLOAD – special I/O loader.

☐ Plus lots more.

☐ Fitted in minutes – no soldering usually required. (On some 64's the old ROM may have to be desoldered).

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☐ Turn your Smart Cart into a 32K RAM/disk.

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☐ Now with full sound editing module to produce outstanding effects.

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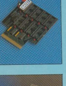

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- ☐ Burst Nibbler is actually a two part system — a software package **and** a parallel cable to connect the 1541/1570/1571 to 64/128 (state type).
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- ☐ Quickly and easily double your disk capacity.
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- ☐ A top quality, easy-to-use EPROM programmer for the 64/128.
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- ☐ We believe Eprommer 64 is the most comprehensive, most friendly and best value for money programmer available for the 64/128.
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- ☐ Comes complete with instructions — plus the cartridge handbook.

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PROFESSIONAL DOS ™ MIKROTRONIC

£64.99 POST FREE with Disc Demon operating system

"The world's fastest parallel operating system"

☐ Loads a typical 202 block program file in under 3 seconds!

☐ 60x faster load (PRG files).

☐ 25x faster load (SEQ files).

☐ 20x faster save (PRG files).

☐ 20x faster save (SEQ files).

PLUS AN ADVANCED COMMAND STRUCTURE INCLUDING:

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☐ Fload will fastload files up to 250 blocks (other similar systems will only cope with 202 blocks).

☐ Number conversion. ☐ Reset.

☐ Unique built in file copier will copy files up to 250 blocks like lightning – multiple copy options – perfect for copying Action Replay files.

☐ Highly compatible with commercial software – can be switched out for non compatible programs.

☐ Perfect for use with Action Replay 3 – a typical AR3 backup will reload in about 3 seconds – yes 3 seconds!

☐ Speeds up other DOS functions including verify, scratch etc.

☐ Comes complete with superfast file and whole disk copier free!

☐ Screen on or off during loading.

☐ Enhanced command set – over 30 new commands.

☐ Easily fitted – Disk Demon plugs inside the 1541 and the new operating system chip plugs inside the C64/128. Fitting takes only minutes and usually requires no soldering.

☐ User port throughbus supplied free – you could pay £15.00 for this alone.

☐ Supplied complete – no more to buy.

☐ Works on C128/1541 in 64 or 128 mode.

C128 version

£69.99

BLUE CHIP DRIVE

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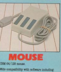

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C128 HELPER

A friend in need is a friend indeed. Meet a utility which throws you a line or two

By Eric Doyle

Here I am, sitting at my C128 begging for help with my latest program. I want to use a sprite but can't remember the correct syntax for the command. With relief, I notice a button marked HELP in bold letters – very comforting. I press it but nothing useful happens. My only recourse is thumbing through the wretched manual – or is it? Not with the C128 Helper on board. I press the help button and lo and behold, I can call up any keyword and see a description of the command and an example of its syntax.

The C128 Helper is a clever utility which uses specially created disk files to instantly display information on the screen using a small resident program. The usefulness of the program can also grow as your knowledge expands through a special editing program.

Each page of information is stored as a separate file on the disk and the ingenious operating system allows about 166 files to be held on each Helper disk. This exceeds the stated maximum disk capacity of 144 files and this is one good reason why a Helper disk should never be validated. Owners of double-sided disk drives will have access to twice as many files, which means that all of the Basic commands could be stored as well as almost 200 extra pages of information on peeks and pokes, or even a complete memory map!

The disk contains two utility programs to assist in the creation of customised screens and an associated

Key Poke Locations

```
Location: DEC.(HEX)         Description:

45.46 ($2D.$2E).........Start of BASIC text. Low Byte (LB). High byte (HB).
47.48 ($2F.$30).........Start of BASIC variables in BANK 1. LB. HB format.
131 ($83)...............Current color for GRAPHICS commands.
512 - 673 ($200-$2A1)...BASIC input buffer.
808 ($328)..............Enable (=110) / Disable (=112) RUN/STOP key.
842-851 ($34A-$353).....Keyboard Buffer. (10 bytes)
2592 ($A20).............Maximum size of keyboard buffer.
2593 ($A21).............If <>0. then pause output until a key is hit (NO SCROLL)
2594 ($A22).............Enable (=128) / Disable (=64) key repeats.
2599 ($A27).............Cursor Enable (=0) / Disable (<>0) in 40 column programs
4096-4105 ($1000-$1009).Programmable Function key lengths.
4106-4351 ($100A-$10FF).Programmable Function key strings.
4401.4402 ($1131.$1132).Current X position on GRAPHICS screen (LB. HB format)
4403.4404 ($1133.$1134).Current Y position on GRAPHICS screen (LB. HB format)
53248-53263.............X & Y Sprite locations for sprite numbers 0 thru 7.
      ($D000-$D00F)     (e.e. - 53248: X of sprite 0. 53249: Y of sprite 0. etc)
53280 ($D020)...........Border color (40 columns).
53296 ($D030)...........(=0) 1 MHz operation. (=255) 2 MHz operation.


         ESCape Keys -                                          (ref p.368)

         Press the ESC key down. release it. and then press one of the
         following keys to get the desired editing function.

         @ - Erase to end of page          N - Set normal screen display
         A - Automatic Insert mode         O - Cancel quote mode
         B - Set Bottom Window             P - Erase to start-of-line
         C - Cancel insert mode            Q - Erase to End-of-line
         D - Delete current line           R - Set Reverse display
         E - Set non-flashing cursor       S - Set block cursor
         F - Set flashing cursor           T - Set Top of window
         G - Enable Bell                   U - Set Underline cursor
         H - Disable bell                  V - Scroll up one line
         I - Insert a line                 W - Scroll down one line
         J - Move to beginning of line     X - Toggle 40-80 columns
         K - Move to end of line           Y - Restore default Tabs
         L - Turn on scrolling             Z - Clear all Tabs
         M - Turn off scrolling

         Example: Press ESC. release it. and then press U. and your cursor
                  will change to a single line instead of a block.
```

menu. The Editor program is particularly impressive because it allows a fully comprehensive screen editing facility.

When designing a screen it is important that the screen does not scroll up as you type information into the last line. The editor does this for you and you can move the cursor around the screen adding and subtracting information as you go ignoring colour information until last.

When colour needs to be added, the Editor has a special command which allows you to pull the cursor across letters after selecting a colour. Each character that the cursor covers will be changed to the current colour.

When the screen is designed, the program will then save it to disk using a compressing routine so that the minimum disk space is used. This typically compresses about 16 blocks of screen information into a mere four blocks.

From inside Helper any screen can be dumped to a printer or plotter by pressing the Commodore key and in normal programming mode this facility is still available using SHIFT with RUN/STOP.

The program obviously uses some of the C128's memory but, as the excellent documentation shows, these locations don't affect the Basic programming space too much. Even when accessing the Helper, the screen display at entry is stored away and on return to Basic programming mode the screen is restored intact.

Helper makes full use of all of the function keys and the ALT key can also be used to 'boot' up a new Helper disk and its menu. This means that a full library of disks can be created to allow instant access to any information which may be relevant to your programming needs. Even though the HELP key is used for calling up Helper, the resident HELP command is still accessible by typing in the keyword in direct mode.

The applications for Helper are only limited by your own imagination. Used in conjunction with your own program, you could use Helper as a help facility within a utility of your own such as a word processor, database or game. With careful planning even machine code programs can access Helper because of the detailed information on the memory locations accessed by the master program which are given in the small accompanying manual.

For the programmer, C128 Helper is a significant improvement on book assisted programming. On its own the basic information given with Helper is worth a king's ransom, adding the editing facilities makes this an essential time saver utility.

Every angle seems to be covered. The C128 is disturbed as little as possible from its normal operational mode and some of the information given, answers questions which keep cropping up in letters to the editor. For example, not many people know this but the keyboard buffer lies between locations 842 and 851. I haven't seen this documented anywhere else, so thank you C128 Helper.

Touchline:
Product: *C128 Helper.* ***Machine:*** *C128 Plus 1541/1570/1571 disk drive, or C128D.* ***Supplier:*** *Financial Systems Software Ltd, 2nd Floor, Anbrian House, St. Marys Street, Worcester WR1 1HA.* ***Tel:*** *0905 611463.* ***Price:*** *£24.95.*

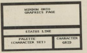
Screendraw 64

A powerful background and character editor

By Paul Williams

When writing on the Commodore it is common to draw each screen, and to use sprites and more user-defined characters for the objects that move.

Screendraw is a machine-code program to assist with the design of such screens. There are already a few programs around to do this, but I for one, have found them cumbersome to use as they often involve selecting one screen option for designing a character, then going to a page display to insert that character into the picture, then if it doesn't quite look right going back to the character edit screen where you can't see the character in context, and so on. With this in mind I have written a screen designer which is extremely simple and quick to use, and most importantly displays everything on the same screen at the same time. A joystick in Port 2 does the bulk of the work, assisted by a few easy to remember keypresses. SYS 49152 runs the program. The screen then shows the following:



The program works with a picture 256 characters across by 64 characters down. This is to enable any size of screen to be drawn and because of the simple way such a picture is stored in memory it is easy to extract completed screens for use in your own programs (refered to later). The top section of the screen displays a 40×16 window of this page – when you move off the screen with the joystick the window scrolls.

The bottom left section of the screen shows the full character set available to be used and edited, in full colour. The program allows hi-resolution 2-colour and lower-resolution 4-colour characters (multicolour), and lets you assign a particular unique colour for each character which is remembered in a table. This seems to be the most efficient and easy-to-use method of defining all the colours for a multicoloured screen.

The bottom right corner of the screen shows an 8×8 grid which displays the exact pixel representation of the current character, and is also used to edit the characters.

Below the picture window is a line containing useful information, the current location in memory of the picture window (in hex), the four colours relevant to the current characters (in hex), and the number of the current character (decimal 0-255). This area is also used for entering filenames and telling you what is going on when disk operations are happening.

On the screen, there are three modes of operation, depending on which part of the screen your joystick-controlled cursor is in. Moving between the screen windows is performed by the keys SPACE for the picture, E for editing a character and P for selecting a character from the palette (i.e. character set).

Picture Mode – the FIRE button draws the current character (displayed on the bottom-right grid) onto the picture. The following keys have the following:

P – Move to Palette to select a character, see PALETTE MODE >

B – Get character under cursor and make it the current character (so you don't have to go to the palette to get a previously-used character).

D – Duplicate character under cursor onto current edit character. After selecting a character with P or G, if it is to be similar to another character, use D to set its pixels and colours to that of the old character, and then use E to edit it.

E – Moves you to character EDIT MODE (see below). STOP ends the program.

I – Takes a 40×25 image of the picture using the cursor position as the top left corner of the image and puts it away in a 1K block of memory at 15360-16359, for use in your own programs. Alternatively you can read the picture memory block directly with your own BASIC or machine-code programs (see later).

CLR Clears everything, and copies the ROM character set into your character space.

CURSOR Inserts a space in the current line and shifts all

RIGHT Further right characters up one.

CURSOR Deletes the character under the cursor and shuffles.

LEFT all the rest down.

L Load character set from disk.

SHFT-L Load picture from disk.

SHFT-S Save picture to disk.

SHFT-1 Mark this position as the top left corner of a block to be copied.

SHFT-2 Mark this position as the bottom right corner of a block to be moved.

SHFT-3 Copy the screen block defined by SHIFT-1 and SHIFT-2 to where the cursor currently is.

PALLETE MODE – you use the joystick to position the cursor over the character you want, then FIRE to select that as the current character and move you back to PICTURE MODE.

CHARACTER EDIT MODE – the fire button is used to draw and erase pikels in the character being edited. The 8k8 pikel grid shows an exact enlarged version of the character, and when in multicolour mode the colours here also reflect the colours of the character, even though every pair of bits is then used to define one coloured pikel in the character (this follows the usual convention of Commodore 64 multi-coloured characters).

SPACE	Takes you back to PICTURE MODE.
CLR	Clears the current character.
1	Advance screen background colour by 1.

2	Advance character foreground colour by 1.
3	Advance common multicolour no. 1 by 1
4	Advance common multicolour no. 2 by 1.
CURSOR	Shift the character by 1 pixel in each of the 4 KEYS cursor directions.

To see how to incorporate your pictures in your programs it is best to take a look at the memory map used by SCREENDRAW.

Memory Area	Usage
$2F00-$2FFF	Character colour attribute table
$300-$37FF	User-efeined character set
$3800-$38FF	SCREENDRAW workplace
$3000-$3FFF	1K screen dump area (used by key 1)
$4000-$7FFF	Graphics page (256k64)
$0000-$CDFF	SCREENDRAW Program

The save and load facilities in Screendraw act on memory areas $2F00-$37FF for the character set and $4000-$7FFF for the graphics page. Once a file has been created on disk it can be loaded back independently for your use with LOAD"Filename",8,1. Alternatively, when you leave Screendraw the memory is still set up as above, so you can fish out relevant bits as you wish. Incidentally, Screendraw can be resident with the Commodore DOS support program, which occupies locations $CC00-$CFFF.

For example, the following short BASIC program will extract the top left 40k25 screensworth of the picture and display it on the screen.

This program could be adapted to extract any size, of picture by changing the values in lines 120 and 130; and if you want to retrieve a picture from a different point in the graphics page set A – 16384 (starting k) 256* (starting y).

One more point – character 0 and 253, 254 and 255 are used by screendraw. If you wish to redefine these particular characters you can – but the screendraw screen may then look a bit funny, even though it will still function correctly. In most cases, if you can leave these four characters alone it is advisable to do so.

```
10 POKE56,47:CLR:REM PROTECT
MEMORY
20 PRINTCHR$(147):REM CLEAR THE
SCREEN
30 POKE53272,29:REM TELL VIC
WHERE CHARACTER SET IS.
40 POKE53270,PEEK(53270)OR16:REM
MULTICOLOUR MODE
50 POKE53281,C1:REM SET UP
COLOURS - C1,C2 AND C3 SHOULD BE
THE 1ST 2ND AND 4TH COLOURS ON
THE SCREEN IN SCREENDRAW
60 POKE53282,C2
70 POKE53283,C3
80 S=1024:REM SCREEN ADDRESS
90 C=55296:REM COLOUR MAP
ADDRESS
100 P=16384:REM PICTURE START
ADDRESS
110 T=12032:REM COLOUR ATTRIBUTE
ADDRESS
120 FORY=0TO24:REM 25 LINE
SCREEN
130 FORX=0TO39:REM 40 CHARACTERS
ACROSS THE SCREEN
140 CH=PEEK(P+X+256*Y):REM
EXTRACT CHARACTER FROM PICTURE
150 POKES+X+40*Y,CH:REM DRAW
CHARACTER
160 POKEC+X+40*Y,PEEK(T+CH):REM
SET COLOUR
170 NEXTX,Y
180 GETA$:IFA$=""THEN180:REM
WAIT FOR KEYPRESS
190 POKE53272,21:REM ROM
CHARACTER SET
200 POKE53270,PEEK(53270)
AND239:REM NORMAL COLOUR MODE
210 END
```

See listings on page 100

C16 & Plus/4 Software Offer

Do you wish that more C16 and Plus/4 programs were available on disk or cassette? Well here's our third C16 and Plus/4 software collection

Due to the great length and complexity of the programs that are published in *Your Commodore*, many people find that once they have typed them in they do not work. Usually, this is not the fault of the magazine, but rather, due to the program, being typed incorrectly.

To help readers we do provide a *Software for Sale* service that makes all of the programs from each month's magazine available on disk or tape. Due to the small number of programs that we publish for the C16 and Plus/4 we only place the software for those machines on the disk with all of the other software from the issues.

In this issue we are pleased to announce the launch of our third C16 and Plus/4 four collection containing no fewer than eight programs from past issues of *Your Commodore*.

Documentation

All of the programs that are on the tape or disk are from recent issues of the magazine, however, instructions are included with the programs in case you missed any of the magazines.

What Do You Get?

So just what is on the latest Software cassette or Disk and which machines do they work on?

On both cassette and disk you will find the following:

C16 SPRITES - taken from our August 1987 edition, this program gives C16 and Plus/4 owners access to sprites, just like those to be found on the C64. A demonstration program is also included to show just what is possible.

+4 ANIMATOR — a simple demonstration program showing how you can store a series of pictures in memory to give the appearance of animation (Plus/4 and Expanded C16 only.)

REBOUND - an excellent version of the latest breakout type games.

DISK MENUS- find and load your programs with ease using this program. Obviously this requires a disk drive.

TYPRO - our extremely popular 'typewriter' program from December 1987. Turn you Plus/4 computer and printer into a powerful electronic typewriter.

Plus/4 Assembler - an excellent machine code assembler program for Plus/4 owners.

TRANSCRIPT - owners of the *Script Plus* Cartridge can now convert their Plus 3 text files to work with this wordprocessor.

PLUS/4 EXTENDED BASIC - Add almost 40 new commands to the Basic on you Plus/4, or C16 with memory expansion. Including commands for accessing the disk drive, drawing graphics etc. as well as a whole range of new Basic functions.

C16's and Memory Expansion

The C16 and Plus/4 computers are almost identical, except for the fact that the C16 has far less memory than its big brother the Plus/4. This compatibility means that programs for one of these computers will work on the other, as long as enough memory is available. The exception to this being programs that access the in-built software of the Plus/4, for example, the **TRANSCRIPT** program on this disk or tape.

A number of companies produce memory expansion cartridges for the C16 and expand its memory to varying degrees. If you have expanded your C16's memory to 64K then all of the programs, except **TRANSCRIPT** will work on your machine.

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The price of the software is £5.00 for cassette and £7.00 for disk, this includes instructions. Orders should be sent to the address on the order for *Readers Services*, they should **NOT** be sent to the editorial address.

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LIFESAVERS 10	C64	DEVICE-SET	1/1

If you always use disk for all of your LOAD and SAVE operations it can be a bit annoying having to place the ',8' after every disk operation.

This handy routine will let you set the device (disk or tape) for all loading and saving operations.

Once set you don't even have to type the closing quotes or device number at the end of the filename.

The program works by re-directing the LOAD and SAVE vectors ($0330 and $0332) to a new routine, stored at 679 ($02A7). To use the routine enter:

```
SYS 679   For Disk;
SYS 708   For Tape;
SYS 720   For          normal
          operation.
```

Neil Higgins

```
10 REM *************************
******
20 REM *         DEVICE-SET
     *
30 REM *************************
******
40 REM * SYS 679 :- DEFAULT TO D
ISK  *
50 REM * SYS 708 :- DEFAULT TO T
APE  *
60 REM * SYS 720 :- RESET TO NOR
MAL  *
70 REM *************************
******
80 FORL=679TO758:READA:POKEL,A:D
=D+A:NEXT
90 IFD<>8969THENPRINT"DATA ERROR
":END
100 DATA169,8,141,230,2,141,241,
2,169,229,141,48,3,169,240,141
110 DATA50,3,169,2,141,49,3,169,
2,141,51,3,96,32,175,2
120 DATA169,1,141,230,2,141,241,
2,96,169,165,141,48,3,169,244
130 DATA141,49,3,169,237,141,50,
3,169,245,141,51,3,96,169,8
140 DATA133,186,169,0,133,10,76,
165,244,169,8,133,186,76,237,245
```

Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:
[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:
[SS],[C*]
In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

PROGRAM: SYNTAX CHECKER

```
5 REM SYTAX CHECKER - ERIC DOYLE

10 BL-10    :LN-70    :SA-49152
20 FOR L-0 TO BL:CX-0:FOR D-0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

Mnemonic	Symbol	Keypress
[RIGHT]	]	CRSR left/right
[LEFT]	|	SHIFT & CRSR left/right
[DOWN]	Q	CRSR up/down
[UP]	●	SHIFT & CRSR up/down
[F1]	▔	f1 key
[F2]	▖	SHIFT & f1 key
[F3]	▁	f3 key
[F4]	╮	SHIFT & f3 key
[F5]	|	f5 key
[F6]	╯	SHIFT & f5 key
[F7]	|	f7 key
[F8]	L	SHIFT & f7 key
[HOME]	S	CLR/HOME
[CLR]	♥	SHIFT & CLR/HOME
[RVSON]	R	CTRL & 9
[RVSOFF]	▁	CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]	┐	CTRL & 1
[WHITE]	E	CTRL & 2
[RED]	£	CTRL & 3
[CYAN]	◥	CTRL & 4
[PURPLE]	▚	CTRL & 5
[GREEN]	↑	CTRL & 6
[BLUE]	←	CTRL & 7
[YELLOW]	π	CTRL & 8
[POUND]		£
[LARROW]		←
[UPARROW]		↑
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

YOUR COMMODORE Listings

CHARACTER GRABBER

```
PROGRAM: CHARACTER GRABBER

22   1020 REM *      CHARACTER GRA
     BBER        *
B9   1030 REM *
                 *
B1   1040 REM *  WRITTEN BY ANDRE
     W LEEDER  *
EB   1050 REM *        JANUARY, 19
     88          *
59   1070 REM *******************
     ***********
77   2000 FORL=0TO66:CX=0:FORD=0T
     O15:READA:CX=CX+A:POKE4096+L
     *16+D,A:NEXTD
82   2010 READA:IFA<>CXTHENPRINT"
     ERROR IN LINE";2040+(L*10):S
     TOP
B5   2020 NEXTL
71   2040 DATA165,1,41,254,133,1,
     169,15,141,33,208,169,0,141,
     134,2,1607
93   2050 DATA169,147,32,210,255,
     32,145,18,32,161,17,32,84,18
     ,169,0,1521
3E   2060 DATA133,251,169,16,133,
     252,32,17,18,169,50,133,255,
     32,228,255,2143
7D   2070 DATA201,45,240,67,201,4
     3,240,92,201,133,240,23,201,
     134,240,28,2329
7B   2080 DATA201,135,240,33,201,
     136,240,38,201,83,240,124,20
     1,216,240,117,2646
90   2090 DATA76,45,16,169,16,160
     ,48,162,50,76,177,16,169,64,
     160,49,1453
D3   2100 DATA162,48,76,177,16,16
     9,128,160,50,162,48,76,177,1
     6,169,192,1826
3C   2110 DATA160,51,162,48,76,17
     7,16,174,204,6,228,255,240,1
     75,202,142,2316
C3   2120 DATA204,6,164,252,136,1
     36,136,136,136,136,136,136,1
     32,252,32,17,2147
```

```
F2   2130 DATA18,76,45,16,174,204
     ,6,224,55,240,146,232,142,20
     4,6,164,1952
F5   2140 DATA252,200,200,200,200
     ,200,200,200,200,132,252,32,
     17,18,76,45,2424
81   2150 DATA16,134,255,133,252,
     140,183,6,169,0,133,251,142,
     204,6,32,2056
CE   2160 DATA17,18,76,45,16,76,1
     02,254,32,224,16,160,0,169,3
     2,153,1390
F2   2170 DATA192,7,200,192,40,20
     8,248,32,84,17,32,119,17,76,
     0,16,1480
76   2180 DATA160,0,185,250,19,15
     3,192,7,200,192,11,208,245,2
     4,162,24,2032
FB   2190 DATA160,10,32,240,255,1
     62,0,134,255,32,228,255,240,
     249,172,141,2565
0B   2200 DATA2,201,13,240,52,166
     ,255,201,20,240,35,224,16,24
     0,232,192,2329
15   2210 DATA0,208,228,160,0,217
     ,58,17,240,221,200,192,26,20
     8,246,32,2253
DA   2220 DATA210,255,157,19,20,2
     32,169,100,157,202,7,76,247,
     16,224,0,2091
31   2230 DATA240,197,202,32,210,
     255,76,247,16,96,5,17,18,19,
     28,29,1687
C4   2240 DATA30,31,133,134,135,1
     36,137,138,139,140,141,144,1
     45,146,147,148,2024
AF   2250 DATA156,157,158,159,160
     ,0,185,5,20,153,205,7,200,19
     2,14,208,1979
35   2260 DATA245,32,228,255,240,
     251,201,84,240,7,201,68,240,
     6,76,97,2471
5C   2270 DATA17,162,1,96,162,8,9
     6,32,173,18,169,147,32,210,2
     55,169,1747
FF   2280 DATA1,160,2,32,186,255,
     165,255,162,19,160,20,32,189
     ,255,162,2055
64   2290 DATA0,160,16,169,0,133,
     253,169,8,133,254,169,253,32
     ,216,255,2220
75   2300 DATA96,169,240,141,224,
     5,169,237,141,88,6,169,6,141
     ,224,217,2273
45   2310 DATA141,88,218,162,0,16
     9,195,157,225,5,157,89,6,169
     ,6,157,1944
```

```
71   2320 DATA225,217,157,89,218,
     232,224,38,208,235,169,238,1
     41,7,6,169,2573
62   2330 DATA253,141,127,6,169,6
     ,141,7,218,141,127,218,162,0
     ,189,242,2147
0C   2340 DATA18,24,105,128,157,8
     ,6,169,6,157,8,218,232,224,8
     0,208,1748
BF   2350 DATA237,162,0,189,66,19
     ,157,171,6,232,224,34,208,24
     5,162,0,2112
86   2360 DATA189,100,19,157,252,
     6,169,11,157,252,218,232,224
     ,150,208,240,2584
F1   2370 DATA96,165,251,141,64,3
     ,165,252,141,65,3,169,0,133,
     253,169,2070
17   2380 DATA8,133,254,160,0,177
     ,251,145,253,24,165,251,105,
     1,133,251,2311
FA   2390 DATA165,252,105,0,133,2
     52,24,165,253,105,1,133,253,
     165,254,105,2365
3F   2400 DATA0,133,254,165,254,2
     01,16,208,220,173,64,3,133,2
     51,173,65,2313
ED   2410 DATA3,133,252,96,169,84
     ,133,251,169,4,133,252,169,3
     1,133,253,2265
88   2420 DATA169,0,162,0,160,0,1
     45,251,197,253,240,6,105,1,2
     00,76,1965
46   2430 DATA102,18,168,165,253,
     105,31,133,253,24,165,251,10
     5,40,133,251,2197
23   2440 DATA165,252,105,0,133,2
     52,152,160,0,105,1,232,224,8
     ,208,214,2211
08   2450 DATA96,120,169,201,141,
     20,3,169,18,141,21,3,169,129
     ,141,26,1567
BB   2460 DATA208,169,27,141,17,2
     08,169,127,141,13,220,88,96,
     120,169,0,1913
09   2470 DATA141,26,208,169,255,
     141,13,220,169,49,141,20,3,1
     69,234,141,2099
1A   2480 DATA21,3,169,21,141,24,
     208,88,96,169,1,141,25,208,1
     62,21,1498
8B   2490 DATA160,0,173,18,208,20
     1,146,240,4,162,19,160,146,1
     42,24,208,2011
60   2500 DATA142,32,208,140,18,2
     08,173,13,220,74,144,3,76,49
     ,234,76,1810
```

```
B2  2510 DATA188,254,66,32,32,32
    ,32,32,32,32,32,32,32,3,8,1,
    840
9C  2520 DATA18,1,3,20,5,18,32,7
    ,18,1,2,2,5,18,32,32,214
F8  2530 DATA32,32,32,32,32,32,3
    2,32,32,66,66,23,18,9,20,20,
    510
4F  2540 DATA5,14,32,2,25,32,1,1
    4,4,18,5,23,32,12,5,5,229
6D  2550 DATA4,5,18,44,32,10,1,1
    4,21,1,18,25,32,49,57,56,387
EB  2560 DATA56,66,22,9,4,5,15,3
    2,2,1,14,11,58,32,48,32,407
5D  2570 DATA32,32,32,32,3,8,1,1
    8,1,3,20,5,18,32,19,5,261
CF  2580 DATA20,58,32,50,21,19,5
    ,32,6,21,14,3,20,9,15,14,339
89  2590 DATA32,11,5,25,19,32,20
    ,15,32,3,8,1,14,7,5,32,261
87  2600 DATA2,1,14,11,32,32,32,
    32,32,32,32,14,21,13,2,5,307
0A  2610 DATA18,44,32,1,14,4,32,
    43,32,1,14,4,32,45,32,11,359
EB  2620 DATA5,25,19,32,20,15,32
    ,3,8,1,14,7,5,32,32,32,282
3E  2630 DATA32,32,20,8,5,32,3,8
    ,1,18,1,3,20,5,18,32,238
14  2640 DATA19,5,20,46,46,46,32
    ,16,18,5,19,19,32,3,15,14,35
    5
6E  2650 DATA20,18,15,12,45,19,3
    2,32,32,32,32,32,32,32,20,15
    ,420
18  2660 DATA32,19,1,22,5,32,19,
    5,20,32,20,15,32,20,1,16,291
18  2670 DATA5,32,15,18,32,4,9,1
    9,11,46,6,9,12,5,14,1,238
E5  2680 DATA13,5,58,32,100,148,
    1,16,5,32,15,18,32,132,9,19,
    635
9E  2690 DATA11,32,63,0,0,0,0,0,
    0,0,0,0,0,0,0,0,0,106
26  2700 DATA0,0,0,0,255,240,0,2
    08,0,208,144,0,15,176,248,0,
    1494
83  2990 :
9A  3000 REM SAVE MACHINE CODE T
    O TAPE/DISK
07  3010 POKE43,0:POKE44,16:POKE
    45,36:POKE46,20
F9  3020 REM CHANGE ',8' TO ',1'
     FOR TAPE
10  3030 SAVE"CHAR GRABBER",8
```

POINT TO POINT

PROGRAM: HI-RES SETTER

```
40  1 REM******* SET POINTERS **
    ************
0C  2 DATA173,2,221,9,3,141,2,22
    1,173,0,221,41,252,9,0,141,0
    ,221,169,57,141,24,208
73  3 DATA173,17,208,9,32,141,17
    ,208,96:REM*
76  4 REM**** SET BLACK B/G  YEL
    LOW F/G ****
94  5 DATA169,204,141,118,3,169,
    112,160,0
6B  6 DATA153,0,204,200,208,250,
    238,118,3,173,118,3,201,208,
    208,236,96:REM *********
95  7 REM********** CLEAR SCREEN
     ***********
80  8 DATA169,224,141,143,3,169,
    0,168,153,0,224,200,208,250,
    238,143,3,173,143
15  9 DATA3,208,239,96,999
06  10 READA:IFA=999THEN40
72  20 POKE843+X,A:X=X+1:GOTO10
04  40 SYS875:REM SET SCREEN COL
    OURS
F7  50 SYS901:REM CLEAR THE SCRE
    EN
EA  60 SYS843:REM SELECT PAGE SE
    TUP
```

PROGRAM: HI-RES DEMO

```
C3  0 DATA169,53,133,1,160,0,177
    ,250,133,252,169,55,133,1,96
    :REM PEEK UNDER ROM ****
40  1 REM******* SET POINTERS **
    ************
0C  2 DATA173,2,221,9,3,141,2,22
    1,173,0,221,41,252,9,0,141,0
    ,221,169,57,141,24,208
73  3 DATA173,17,208,9,32,141,17
    ,208,96:REM*
76  4 REM**** SET BLACK B/G  YEL
    LOW F/G ****
94  5 DATA169,204,141,118,3,169,
    112,160,0
6B  6 DATA153,0,204,200,208,250,
    238,118,3,173,118,3,201,208,
    208,236,96:REM *********
95  7 REM********** CLEAR SCREEN
     ***********
80  8 DATA169,224,141,143,3,169,
    0,168,153,0,224,200,208,250,
    238,143,3,173,143
15  9 DATA3,208,239,96,999
01  10 READA:IFA=999THEN30
53  20 POKE828+X,A:X=X+1:GOTO10
25  30 BASE=14*4096
04  40 SYS875:REM SET SCREEN COL
    OURS
F7  50 SYS901:REM CLEAR THE SCRE
    EN
EA  60 SYS843:REM SELECT PAGE SE
    TUP
54  1000 X1=1:X2=16:Y1=0:Y2=16
10  1010 IFX2-X1=0THENFORY=Y1TOY
    2:X=X1:GOSUB1260:NEXT:GOTO10
    50
D6  1020 FORX=X1TOX2:Y=((Y2-Y1)/
    (X2-X1))*X
F0  1030 GOSUB1260
EE  1040 NEXTX
A5  1050 X1=0:X2=32:B=7:C=1/B:IF
    C>1THENC=1
5B  1060 FOR X=X1TOX2STEPC
B9  1070 Y=INT(B*X+.5):IFY>200TH
    ENX=X2:GOTO1090
36  1080 GOSUB1260
C4  1090 NEXT
69  1100 X1=0:X2=60:YY=100:D=60:
    SE=100
18  1110 FORXX=X1TOX2
39  1120 Y1=YY+SQR(D*XX-XX*XX):I
    FY1<0THENY1=0
15  1130 IFY1>200THENY1=200
73  1140 Y2=YY-SQR(D*XX-XX*XX):I
    FY2>200THENY2=200
37  1150 IFY2<0THENY2=0
8E  1160 FORY=Y1TOY2STEPY1-Y2:X=
    XX+SE:GOSUB1260
C1  1170 NEXTY,XX
73  1180 FORXX=X2TOX1STEP-1
1D  1190 Y1=YY+SQR(D*XX-XX*XX):I
    FY1>200THENY1=200
F9  1200 IFY1<0THENY1=0
D5  1210 Y2=YY-SQR(D*XX-XX*XX):I
    FY2>200THENY2=200
91  1220 IFY2<0THENY2=0
1C  1230 FORY=Y2TOY1STEPY2-Y1:X=
    XX+SE:GOSUB1260
AB  1240 NEXTY,XX
66  1250 END
8F  1260 COLUMN=INT(X/8)
64  1270 ROW=INT(Y/8)
8A  1280 BYTE=Y AND 7
69  1290 LOC=BASE+ROW*320+COLUMN
    *8+BYTE
8F  1300 BIT=7-(XAND7)
7F  1310 BH%=LOC/256:BL=LOC-BH%*
    256
1D  1320 POKE250,BL:POKE251,BH%
0B  1330 SYS828
14  1340 POKELOC,PEEK(252)OR(2^B
    IT)
C5  1350 RETURN
2E  1360 REM IN LINE 1000 CHANGE
     X2 AND Y2
20  1370 REM IN LINE 1050 CHANGE
     X2 OR B
AA  1380 REM IN LINE 1100 CHANGE
     X2,YY,D OR SE
```

CHARACTER BUILDING

PROGRAM: ROM RAIDER

```
14  10 REM**********************
    ************           LINES 80
    TO 160 WILL POKE THE
21  20 REM PROGRAM INTO MEMORY.
    THE PROGRAM          CAN BE RE
    LOCATED ANYWHERE IN
7A  30 REM MEMORY SIMPLY BY CHAN
    GING                 POKE 4915
    2+X  IN LINE 120 TO ANY
20  40 REM OTHER VALUE AND THE S
    YS CALL IN           LINE 160
    ACCORDINGLY.
69  50 REM TO TRY THE REST OF TH
    E PROGRAM,           USE 12288
     OR MORE WHEN PROMPTED
34  60 REM TO ENTER A VALUE.
09  70 REM**********************
    ************
92  80 DATA 173,14,220,41,254,14
    1,14,220,165,1,41,251,133,1,
    173,252,3,133
14  90 DATA 251,173,251,3,133,25
    0,169,0,133,252,169,208,133,
    253,162,2,160
E6  100 DATA 0,177,252,145,250,2
    00,208,249,202,240,6,230,253
    ,230,251,208,238
E6  110 DATA 165,1,9,4,133,1,173
    ,14,220,9,1,141,14,220,96,99
    9
D2  120 READA:IFA<>999THENPOKE49
    152+X,A:X=X+1:GOTO120
48  130 INPUT"[CLR]START OF CHAR
    ACTER MEMORY BLOCK";S
09  140 SH=S/256:SL=S-SH*256
BC  150 POKE1020,SH:POKE1019,SL
78  160 SYS49152
25  170 REM
71  180 REM ********************
```

```
   *****
54 190 REM * DEMONSTRATION PROG
   RAM *
80 200 REM ********************
   *****
5D 210 REM
DE 220 POKE52,48:POKE56,48:CLR
1F 230 POKE53280,0:POKE53281,0
43 240 B$="[DOWN,LEFT10]"
22 250 ROW$="[S-,SPC8,S-]"
E4 260 GRID$="[HOME,CA,S*8,CS]"

92 270 FORA=1TO8:GRID$=GRID$+B$
   +ROW$:NEXT
05 280 GRID$=GRID$+B$+"[CZ,S*8,
   CX]"
72 290 PRINT"[CLR,BLUE]"GRID$
7C 300 FORA=0TO63:POKE1504+A*2,
   A:POKE1504+A*2+54272,14:NEXT

08 310 PRINT"[HOME,DOWN,RIGHT12
   ]SELECT A CHARACTER"
DC 320 PRINT"[DOWN,RIGHT12]USIN
   G THE CURSOR KEYS"
11 330 A=1504:F=A
53 340 GOTO430
1B 350 GETA$
AE 360 IFA$="[UP]"THENF=F-40:GO
   TO410
FB 370 IFA$="[DOWN]"THENF=F+40:
   GOTO410
6D 380 IFA$="[RIGHT]"THENF=F+2:
   GOTO410
3C 390 IFA$="[LEFT]"THENF=F-2:G
   OTO410
AE 400 GOTO350
17 410 IFF<1504ORF>1630THENF=A:
   GOTO350
55 420 POKEA+54272,14:POKE198,0

59 430 A=F:POKEA+54272,1
07 440 C=PEEK(A)*8+PEEK(1019)+P
   EEK(1020)*256:PRINT"[HOME]"
0E 450 FORM=CTOC+7:D=PEEK(M)
29 460 IFDAND128THENC$="[SQ]":D
   =DOR128:GOTO480
86 470 C$="[BLUE].[WHITE]"
33 480 IFDAND64THENC$=C$+"[SQ]"
   :D=DOR64:GOTO500
C5 490 C$=C$+"[BLUE].[WHITE]"
55 500 IFDAND32THENC$=C$+"[SQ]"
   :D=DOR32:GOTO520
99 510 C$=C$+"[BLUE].[WHITE]"
D6 520 IFDAND16THENC$=C$+"[SQ]"
   :D=DOR16:GOTO540
04 530 C$=C$+"[BLUE].[WHITE]"
EA 540 IFDAND8THENC$=C$+"[SQ]":
   D=DOR8:GOTO560
88 550 C$=C$+"[BLUE].[WHITE]"
58 560 IFDAND4THENC$=C$+"[SQ]":
   D=DOR4:GOTO580
5C 570 C$=C$+"[BLUE].[WHITE]"
B7 580 IFDAND2THENC$=C$+"[SQ]":
   D=DOR2:GOTO600
20 590 C$=C$+"[BLUE].[WHITE]"
A8 600 IFDAND1THENC$=C$+"[SQ]":
   GOTO620
F4 610 C$=C$+"[BLUE].[WHITE]"
89 620 PRINT"[RIGHT]"C$
FA 630 NEXT
3B 640 GOTO350
```

PROGRAM: CHARACTER SAVER

```
EF 10 DATA230,254,208,4,230,255
   ,160,0,177,252,145,250,230,2
   52,208,2,230
30 20 DATA253,165,252,197,254,2
   08,7,165,253,197,255,208,1,9
   6,230,250,208
18 30 DATA2,230,251,208,225,999
9C 40 READ A:IFA=999 THEN 60
40 50 POKE49152+X,A:X=X+1:GOTO4
   0:REM CHANGE 49152 FOR EASY
   RELOCATION
F1 60 INPUT"[CLR]OLD START LOCA
   TION";OS
8A 70 INPUT"[DOWN]  OLD END LOC
   ATION";OE
D6 80 INPUT"[DOWN]NEW START LOC
   ATION";NL
E7 90 SH=INT(OS/256):SL=OS-SH*2
   56
93 100 EH=INT(OE/256):EL=OE-EH*
   256
B6 110 NH=INT(NL/256):NL=NL-NH*
   256
C3 120 POKE250,NL:POKE251,NH
87 130 POKE252,SL:POKE253,SH
41 140 POKE254,EL:POKE255,EH
35 150 SYS49152
```

SCREENDRAW 64

```
E3 100 DATA76,110,193,173,22,20
   8,9,16,807
6B 110 DATA141,22,208,169,29,14
   1,24,208,942
78 120 DATA169,11,141,32,208,16
   9,0,141,871
03 130 DATA33,208,169,12,141,34
   ,208,169,974
ED 140 DATA15,141,35,208,169,25
   5,141,138,1102
55 150 DATA2,96,169,0,141,21,20
   8,141,778
04 160 DATA33,208,169,21,141,24
   ,208,173,977
1C 170 DATA22,208,41,239,141,22
   ,208,169,1050
0A 180 DATA7,141,134,2,169,147,
   76,210,886
E0 190 DATA255,162,7,169,0,157,
   0,48,798
C1 200 DATA169,255,157,248,55,1
   69,85,157,1295
56 210 DATA232,55,169,170,157,2
   40,55,202,1280
D0 220 DATA16,233,169,3,141,0,4
   7,169,778
09 230 DATA15,141,253,47,141,25
   4,47,141,1039
C5 240 DATA255,47,169,48,141,4,
   48,96,808
09 250 DATA162,0,169,0,157,0,4,
   157,649
CA 260 DATA0,5,157,0,6,157,0,7,
   332
55 270 DATA169,3,157,0,216,157,
   0,217,919
A2 280 DATA157,0,218,157,0,219,
   232,208,1191
E0 290 DATA225,169,168,133,253,
   169,6,133,1256
78 300 DATA254,169,168,133,97,1
   69,218,133,1341
2F 310 DATA98,173,64,3,72,169,2
   55,141,975
5F 320 DATA64,3,160,0,238,64,3,
   173,705
54 330 DATA64,3,145,253,170,189
   ,0,47,871
E5 340 DATA145,97,200,192,32,20
   8,237,24,1135
F4 350 DATA165,253,105,40,133,2
   53,165,254,1368
77 360 DATA105,0,133,254,24,165
   ,97,105,883
1C 370 DATA40,133,97,165,98,105
   ,0,133,771
CB 380 DATA98,173,64,3,201,255,
   208,202,1204
E7 390 DATA162,39,189,253,192,1
   57,128,6,1126
87 400 DATA169,7,157,128,218,20
   2,16,242,1139
44 410 DATA104,141,64,3,96,13,5
   ,13,439
DB 420 DATA32,12,15,3,58,36,32,
   32,220
F7 430 DATA32,32,32,32,32,3,15,
   12,190
BA 440 DATA15,21,18,19,58,36,32
   ,32,231
6C 450 DATA32,32,32,32,32,32,3,
   8,203
CC 460 DATA18,58,32,32,32,173,6
   6,3,414
25 470 DATA133,251,173,67,3,133
   ,252,169,1181
2E 480 DATA0,133,99,169,4,133,1
   00,169,807
07 490 DATA16,141,109,193,160,3
   9,177,251,1086
B0 500 DATA145,99,170,165,100,7
   2,24,105,880
1A 510 DATA212,133,100,189,0,47
   ,145,99,925
5A 520 DATA104,133,100,136,16,2
   32,230,252,1203
31 530 DATA24,165,99,105,40,133
   ,99,165,830
E2 540 DATA100,105,0,133,100,20
   6,109,193,946
EC 550 DATA208,210,76,180,199,0
   ,32,3,908
2A 560 DATA192,162,0,189,0,203,
   157,0,903
50 570 DATA56,232,208,247,32,73
   ,192,32,1072
6E 580 DATA120,192,32,144,198,1
   69,0,141,996
BA 590 DATA66,3,169,64,141,67,3
   ,169,682
FB 600 DATA0,141,69,3,141,68,3,
   141,566
48 610 DATA70,3,141,71,3,169,0,
   141,598
8B 620 DATA64,3,32,37,193,32,23
   7,194,792
33 630 DATA169,1,141,21,208,169
   ,224,141,1074
1D 640 DATA248,7,32,145,195,173
   ,65,3,868
BC 650 DATA41,4,208,25,173,70,3
   ,208,732
FB 660 DATA17,173,68,3,240,15,2
   06,68,790
31 670 DATA3,206,66,3,32,37,193
   ,76,616
E8 680 DATA213,193,206,70,3,173
   ,65,3,926
8E 690 DATA41,8,208,29,173,70,3
   ,201,733
15 700 DATA39,208,19,173,68,3,2
   01,216,927
9B 710 DATA240,15,238,68,3,238,
   66,3,871
D7 720 DATA32,37,193,76,249,193
   ,238,70,1088
5F 730 DATA3,173,65,3,41,1,208,
   25,519
E3 740 DATA173,71,3,208,17,173,
   69,3,717
F2 750 DATA240,15,206,69,3,206,
   67,3,809
14 760 DATA32,37,193,76,25,194,
   206,71,834
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CD  770 DATA3,173,65,3,41,2,208,
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4D  780 DATA173,71,3,201,15,208,
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24  790 DATA69,3,201,48,240,15,2
    38,69,883
E4  800 DATA3,238,67,3,32,37,193
    ,76,649
C4  810 DATA61,194,238,71,3,173,
    65,3,808
4F  820 DATA41,16,208,14,32,216,
    194,173,894
8F  830 DATA64,3,145,251,32,37,1
    93,76,801
F1  840 DATA178,193,32,228,255,2
    40,248,201,1575
91  850 DATA80,208,3,76,218,195,
    201,71,1052
E9  860 DATA208,3,76,117,196,201
    ,68,208,1077
79  870 DATA3,76,131,196,201,69,
    208,3,887
35  880 DATA76,197,196,201,147,2
    08,3,76,1104
48  890 DATA249,198,201,76,208,3
    ,76,211,1222
9E  900 DATA200,201,83,208,3,76,
    8,201,980
50  910 DATA201,204,208,3,76,71,
    201,201,1165
01  920 DATA211,208,3,76,105,201
    ,201,29,1034
22  930 DATA208,3,76,150,201,201
    ,157,208,1204
C1  940 DATA3,76,187,201,201,73,
    208,3,952
FC  950 DATA76,217,201,201,33,20
    8,3,76,1015
68  960 DATA26,202,201,34,208,3,
    76,42,792
32  970 DATA202,201,35,208,3,76,
    58,202,985
91  980 DATA201,3,240,3,76,178,1
    93,32,926
85  990 DATA185,198,32,42,192,16
    2,79,169,1059
E8  1000 DATA0,157,0,2,202,16,25
    0,96,723
F1  1010 DATA160,0,24,173,70,3,1
    09,66,605
B2  1020 DATA3,133,251,24,173,71
    ,3,109,767
8A  1030 DATA67,3,133,252,96,32,
    199,197,979
BF  1040 DATA174,64,3,189,0,47,4
    1,15,533
82  1050 DATA141,135,195,169,200
    ,133,251,169,1393
D4  1060 DATA6,133,252,169,0,141
    ,109,193,1003
45  1070 DATA172,135,195,192,8,1
    76,23,172,1073
BD  1080 DATA109,193,177,99,160,
    7,74,72,891
88  1090 DATA169,0,144,2,169,255
    ,145,251,1135
B7  1100 DATA104,136,16,242,48,3
    9,172,109,866
2E  1110 DATA193,177,99,160,7,16
    2,0,142,940
2A  1120 DATA136,195,74,46,136,1
    95,74,46,902
C0  1130 DATA136,195,72,174,136,
    195,189,141,1238
CC  1140 DATA195,145,251,136,189
    ,137,195,145,1393
F9  1150 DATA251,104,136,16,224,
    24,165,251,1171
4E  1160 DATA105,40,133,251,165,
    252,105,0,1051
5E  1170 DATA133,252,238,109,193
    ,173,109,193,1400
07  1180 DATA201,8,208,164,162,7
    ,173,135,1058
BF  1190 DATA195,157,200,218,157
    ,240,218,157,1542
D5  1200 DATA24,219,157,64,219,1
    57,104,219,1163
A8  1210 DATA157,144,219,157,184
    ,219,157,224,1461
F3  1220 DATA219,202,16,229,76,1
    80,199,3,1124
2B  1230 DATA0,0,254,0,255,0,0,2
    53,762
BD  1240 DATA255,173,70,3,24,105
    ,3,10,643
3B  1250 DATA10,56,233,1,10,141,
    0,208,659
9A  1260 DATA169,0,105,0,141,16,
    208,173,812
C6  1270 DATA71,3,10,10,10,24,10
    5,48,281
3F  1280 DATA141,1,208,238,39,20
    8,173,248,1256
BE  1290 DATA7,24,105,1,201,228,
    144,2,712
39  1300 DATA169,224,141,248,7,1
    62,45,160,1156
98  1310 DATA0,136,208,253,202,2
    08,250,173,1430
53  1320 DATA0,220,141,65,3,96,0
    ,0,525
43  1330 DATA0,17,173,70,3,141,2
    14,195,813
B1  1340 DATA173,216,195,141,70,
    3,173,71,1042
E3  1350 DATA3,141,215,195,173,2
    17,195,141,1280
A5  1360 DATA71,3,32,145,195,173
    ,65,3,687
0C  1370 DATA41,4,208,8,173,70,3
    ,240,747
8A  1380 DATA3,206,70,3,173,65,3
    ,41,564
AC  1390 DATA8,208,10,173,70,3,2
    01,31,704
C4  1400 DATA240,3,238,70,3,173,
    65,3,795
F3  1410 DATA41,1,208,10,173,71,
    3,201,708
A2  1420 DATA17,240,3,206,71,3,1
    73,65,778
66  1430 DATA3,41,2,208,10,173,7
    1,3,511
6A  1440 DATA201,24,240,3,238,71
    ,3,173,953
F3  1450 DATA65,3,41,16,208,180,
    173,71,757
12  1460 DATA3,56,233,17,10,10,1
    0,10,349
EA  1470 DATA10,24,109,70,3,141,
    64,3,424
14  1480 DATA32,237,194,173,70,3
    ,141,216,1066
23  1490 DATA195,173,71,3,141,21
    7,195,173,1168
89  1500 DATA214,195,141,70,3,17
    3,215,195,1206
67  1510 DATA141,71,3,173,0,220,
    41,16,665
72  1520 DATA240,249,76,178,193,
    32,216,194,1378
16  1530 DATA177,251,141,64,3,32
    ,237,194,1099
FF  1540 DATA76,178,193,32,237,1
    94,165,99,1174
79  1550 DATA133,101,165,100,133
    ,102,173,64,971
13  1560 DATA3,72,32,216,194,177
    ,251,141,1086
0B  1570 DATA64,3,32,237,194,160
    ,7,177,874
D8  1580 DATA99,145,101,136,16,2
    49,174,64,984
2E  1590 DATA3,104,141,64,3,168,
    189,0,672
57  1600 DATA47,153,0,47,32,237,
    194,32,742
9D  1610 DATA37,193,32,153,192,3
    2,180,199,1018
D8  1620 DATA76,178,193,32,17,17
    3,70,3,742
F7  1630 DATA141,214,195,173,195
    ,196,141,70,1325
FA  1640 DATA3,173,71,3,141,215,
    195,173,974
EB  1650 DATA196,196,141,71,3,32
    ,145,195,979
97  1660 DATA173,65,3,41,4,208,1
    0,173,677
5C  1670 DATA70,3,201,32,240,3,2
    06,70,825
84  1680 DATA3,173,65,3,41,8,208
    ,10,511
FB  1690 DATA173,70,3,201,39,240
    ,3,238,967
B1  1700 DATA70,3,173,65,3,41,1,
    208,564
CA  1710 DATA10,173,71,3,201,17,
    240,3,718
3B  1720 DATA206,71,3,173,65,3,4
    1,2,564
7B  1730 DATA208,10,173,71,3,201
    ,24,240,930
23  1740 DATA3,238,71,3,173,65,3
    ,41,597
A3  1750 DATA16,240,109,32,228,2
    55,240,173,1293
7A  1760 DATA201,49,208,3,76,218
    ,197,201,1153
B4  1770 DATA50,208,3,76,245,197
    ,201,51,1031
DE  1780 DATA208,3,76,227,197,20
    1,52,208,1172
34  1790 DATA3,76,236,197,201,73
    ,208,3,997
2A  1800 DATA76,106,198,201,17,2
    08,3,76,885
EA  1810 DATA18,198,201,145,208,
    3,76,42,891
F0  1820 DATA198,201,29,208,3,76
    ,68,198,981
62  1830 DATA201,157,208,3,76,87
    ,198,201,1131
38  1840 DATA147,208,3,76,126,19
    8,201,32,991
0F  1850 DATA240,3,76,221,196,17
    3,70,3,982
9E  1860 DATA141,195,196,173,214
    ,195,141,70,1325
A4  1870 DATA3,173,71,3,141,196,
    196,173,956
48  1880 DATA215,195,141,71,3,76
    ,178,193,1072
8B  1890 DATA32,199,197,56,173,7
    1,3,233,964
04  1900 DATA17,168,56,173,70,3,
    233,32,752
11  1910 DATA170,177,99,93,191,1
    97,145,99,1171
C2  1920 DATA32,237,194,173,0,22
    0,41,31,928
8D  1930 DATA201,15,240,247,76,2
    21,196,128,1324
14  1940 DATA64,32,16,8,4,2,1,16
    9,296
EA  1950 DATA6,133,100,173,64,3,
    10,38,527
00  1960 DATA100,10,38,100,10,38
    ,100,133,529
E3  1970 DATA99,96,238,33,208,32
    ,180,199,1085
C4  1980 DATA76,221,196,238,34,2
    08,32,237,1242
07  1990 DATA194,76,221,196,238,
    35,208,32,1200
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14   2000 DATA237,194.76.221.196.
     174,64.3.1165
A9   2010 DATA254.0.47.189.0.47.4
     1.15.593
96   2020 DATA157.0.47.32.237.194
     .32.153.852
AC   2030 DATA192.32.180.199.32.3
     7.193.76.941
62   2040 DATA221.196.32.199.197.
     160.7.136.1148
2D   2050 DATA177.99.200.145.99.1
     36.208.247.1311
E1   2060 DATA169.0.145.99.32.237
     .194.76.952
A4   2070 DATA221.196.32.199.197.
     160.0.200.1205
BE   2080 DATA177.99.136.145.99.2
     00.192.7.1055
61   2090 DATA208.245.169.0.145.9
     9.32.237.1135
F6   2100 DATA194.76.221.196.32.1
     99.197.160.1275
86   2110 DATA7.177.99.74.145.99.
     136.16.753
79   2120 DATA248.32.237.194.76.2
     21.196.32.1236
65   2130 DATA199.197.160.7.177.9
     9.10.145.994
E4   2140 DATA99.136.16.248.32.23
     7.194.76.1038
A3   2150 DATA221.196.32.199.197.
     160.7.177.1189
85   2160 DATA99.73.255.145.99.13
     6.16.247.1070
37   2170 DATA32.237.194.76.221.1
     96.32.199.1187
53   2180 DATA197.160.7.169.0.145
     .99.136.913
59   2190 DATA16.251.32.237.194.7
     6.221.196.1223
2E   2200 DATA120.169.208.141.20.
     3.169.198.1028
CC   2210 DATA141.21.3.169.178.14
     1.18.208.879
41   2220 DATA173.17.208.41.127.1
     41.17.208.932
25   2230 DATA169.129.141.25.208.
     169.241.141.1223
FF   2240 DATA26.208.169.127.141.
     13.220.88.992
11   2250 DATA96.120.169.49.141.2
     0.3.169.767
FA   2260 DATA234.141.21.3.169.12
     9.141.13.851
B5   2270 DATA220.169.0.141.26.20
     8.88.96.948
A5   2280 DATA169.129.141.25.208.
     173.18.208.1071
73   2290 DATA201.186.176.16.169.
     21.141.24.934
EE   2300 DATA208.169.186.141.18.
     208.104.168.1202
F0   2310 DATA104.170.104.64.169.
     29.141.24.805
C1   2320 DATA208.169.178.141.18.
     208.76.49.1047
6E   2330 DATA234.120.169.51.133.
     1.162.0.870
66   2340 DATA189.0.208.157.0.48.
     189.0.791
42   2350 DATA209.157.0.49.189.0.
     210.157.971
45   2360 DATA0.50.189.0.211.157.
     0.51.658
04   2370 DATA189.0.212.157.0.52.
     189.0.799
AD   2380 DATA213.157.0.53.189.0.
     214.157.983
61   2390 DATA0.54.189.0.215.157.
     0.55.670
7B   2400 DATA232.208.205.169.55.
     133.1.88.1091
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27   2410 DATA169.0.133.251.169.6
     4.133.252.1171
A5   2420 DATA162.64.160.0.169.0.
     145.251.951
F2   2430 DATA200.208.251.230.252
     .202.208.246.1797
51   2440 DATA162.0.169.3.157.0.4
     7.232.770
8A   2450 DATA208.250.76.110.193.
     48.49.50.984
71   2460 DATA51.52.53.54.55.56.5
     7.1.379
9F   2470 DATA2.3.4.5.6.72.74.74.
     240
6E   2480 DATA74.74.170.189.93.19
     9.153.128.1080
69   2490 DATA6.200.104.41.15.170
     .189.93.818
4E   2500 DATA199.153.128.6.200.9
     6.153.128.1063
DB   2510 DATA6.200.96.162.255.23
     2.56.233.1240
0F   2520 DATA100.176.250.105.100
     .72.138.9.950
0B   2530 DATA48.32.134.199.104.1
     62.255.232.1166
1B   2540 DATA56.233.10.176.250.1
     05.10.72.912
E9   2550 DATA138.9.48.32.134.199
     .104.9.673
DB   2560 DATA48.76.134.199.160.9
     .173.67.866
1B   2570 DATA3.32.109.199.173.66
     .3.32.617
09   2580 DATA109.199.173.33.208.
     41.15.170.948
48   2590 DATA189.93.199.141.153.
     6.174.64.1019
01   2600 DATA3.189.0.47.41.15.17
     0.189.654
65   2610 DATA93.199.141.155.6.17
     3.34.208.1009
E2   2620 DATA41.15.170.189.93.19
     9.141.157.1005
8F   2630 DATA6.173.35.208.41.15.
     170.189.837
AC   2640 DATA93.199.141.159.6.16
     0.37.173.968
FA   2650 DATA64.3.76.139.199.162
     .39.169.851
E2   2660 DATA32.157.128.6.202.16
     .250.96.887
8C   2670 DATA133.251.134.252.160
     .0.177.251.1358
C8   2680 DATA240.9.41.63.153.128
     .6.200.840
03   2690 DATA76.14.200.96.69.78.
     84.69.686
75   2700 DATA82.32.70.73.76.69.7
     8.65.545
2B   2710 DATA77.69.58.32.0.83.65
     .86.470
B7   2720 DATA73.78.71.32.67.72.6
     5.82.540
82   2730 DATA65.67.84.69.82.32.8
     3.69.551
4A   2740 DATA84.0.76.79.65.68.73
     .78.523
11   2750 DATA71.32.67.72.65.82.6
     5.67.521
29   2760 DATA84.69.82.32.83.69.8
     4.0.503
BA   2770 DATA83.65.86.73.78.71.3
     2.71.559
3C   2780 DATA82.65.80.72.73.67.8
     3.32.554
5B   2790 DATA80.65.71.69.0.76.79
     .65.505
37   2800 DATA68.73.78.71.32.71.8
     2.65.540
B2   2810 DATA80.72.73.67.83.32.8
     0.65.552
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F8   2820 DATA71.69.0.32.253.199.
     169.28.821
80   2830 DATA162.200.32.8.200.16
     9.7.141.919
DB   2840 DATA134.2.169.19.32.210
     .255.162.983
F0   2850 DATA16.169.17.32.210.25
     5.202.208.1109
B8   2860 DATA248.169.16.133.211.
     169.255.141.1342
7D   2870 DATA7.201.238.7.201.32.
     207.255.1148
52   2880 DATA201.13.240.9.174.7.
     201.157.1002
C5   2890 DATA0.2.76.170.200.169.
     0.32.649
C7   2900 DATA144.255.173.7.201.2
     40.7.162.1189
8B   2910 DATA0.160.2.76.189.255.
     104.104.890
46   2920 DATA76.124.193.32.131.2
     00.32.253.1041
95   2930 DATA199.169.66.162.200.
     32.8.200.1036
AD   2940 DATA169.2.160.0.162.8.3
     2.186.719
A7   2950 DATA255.169.0.162.0.160
     .47.32.825
23   2960 DATA213.255.173.253.55.
     141.33.208.1331
23   2970 DATA173.254.55.141.34.2
     08.173.255.1293
5C   2980 DATA55.141.35.208.76.12
     4.193.7.839
42   2990 DATA32.253.199.32.131.2
     00.32.253.1132
93   3000 DATA199.169.45.162.200.
     32.8.200.1015
15   3010 DATA173.33.208.141.253.
     55.173.34.1070
2D   3020 DATA208.141.254.55.173.
     35.208.141.1215
61   3030 DATA255.55.169.2.160.25
     5.162.8.1066
57   3040 DATA32.186.255.169.0.13
     3.251.169.1195
6B   3050 DATA47.133.252.162.0.16
     0.56.169.979
E6   3060 DATA251.32.216.255.76.1
     24.193.32.1179
A7   3070 DATA131.200.32.253.199.
     169.109.162.1255
76   3080 DATA200.32.8.200.169.2.
     160.0.771
EF   3090 DATA162.8.32.186.255.16
     9.0.162.974
54   3100 DATA0.160.64.32.213.255
     .76.124.924
65   3110 DATA193.32.253.199.32.1
     31.200.32.1072
08   3120 DATA253.199.169.88.162.
     200.32.8.1111
27   3130 DATA200.169.2.160.255.1
     62.8.32.988
F9   3140 DATA186.255.169.0.133.2
     51.169.64.1227
D1   3150 DATA133.252.162.0.160.1
     28.169.251.1255
84   3160 DATA32.216.255.76.124.1
     93.32.216.1144
E5   3170 DATA194.165.251.141.7.2
     01.169.0.1128
9F   3180 DATA133.251.160.254.177
     .251.200.145.1571
F5   3190 DATA251.136.136.204.7.2
     01.176.244.1355
51   3200 DATA200.169.0.145.251.3
     2.37.193.1027
72   3210 DATA76.178.193.32.216.1
     94.164.251.1304
3D   3220 DATA169.0.133.251.200.1
     77.251.136.1317
```

```
56   3230 DATA145,251,200,192,255
          ,208,245,169,1665
DE   3240 DATA0,145,251,32,37,193
          ,76,178,912
DA   3250 DATA193,32,216,194,165,
          251,141,25,1217
50   3260 DATA202,169,25,141,7,20
          1,169,0,914
34   3270 DATA133,99,169,60,133,1
          00,160,0,854
5E   3280 DATA162,0,173,25,202,13
          3,251,161,1107
C5   3290 DATA251,145,99,230,251,
          200,192,40,1408
2C   3300 DATA208,245,24,165,99,1
          05,40,133,1019
43   3310 DATA99,165,100,105,0,13
          3,100,230,932
A8   3320 DATA252,206,7,201,208,2
          16,76,178,1344
1C   3330 DATA193,0,32,216,194,16
          5,251,141,1192
34   3340 DATA110,202,165,252,141
          ,111,202,76,1259
00   3350 DATA178,193,32,216,194,
          165,251,141,1370
27   3360 DATA112,202,165,252,141
          ,113,202,76,1263
28   3370 DATA178,193,32,216,194,
          173,111,202,1299
78   3380 DATA133,100,173,110,202
          ,133,99,160,1110
69   3390 DATA0,162,0,161,99,145,
          251,200,1018
2F   3400 DATA230,99,165,99,205,1
          12,202,144,1256
47   3410 DATA242,240,240,230,252
          ,230,100,165,1699
52   3420 DATA100,205,113,202,144
          ,220,240,218,1442
74   3430 DATA32,37,193,76,178,19
          3,0,0,709
AE   3440 DATA0,0,0,0,0,0,0,0,0
B4   3450 DATA0,0,0,0,0,0,0,0,0
C2   3460 DATA0,0,0,0,0,0,0,0,0
CB   3470 DATA0,0,0,0,0,0,0,0,0
D6   3480 DATA0,0,0,0,0,0,0,0,0
DC   3490 DATA0,0,0,0,0,0,0,0,0
EA   3500 DATA0,0,0,0,0,0,0,0,0
F0   3510 DATA0,0,0,0,0,0,0,0,0
FE   3520 DATA0,0,0,0,0,0,0,0,0
04   3530 DATA0,0,0,0,0,0,0,0,0
12   3540 DATA0,0,0,0,0,0,0,0,0
18   3550 DATA0,0,0,0,0,0,0,0,0
26   3560 DATA0,0,0,0,0,0,0,0,0
2C   3570 DATA0,0,0,0,0,0,0,0,0
3A   3580 DATA0,0,0,0,0,0,0,0,0
47   3590 DATA0,0,0,0,0,0,0,0,0
4D   3600 DATA0,0,0,0,0,0,0,0,0
5B   3610 DATA0,0,0,0,0,0,0,0,0
21   3620 DATA255,240,0,128,16,0,
          128,16,783
A4   3630 DATA0,128,16,0,0,0,0,0,
          144
75   3640 DATA0,0,0,0,0,0,0,0,0
94   3650 DATA128,16,0,128,16,0,1
          28,16,432
89   3660 DATA0,255,240,0,0,0,0,0
          ,495
97   3670 DATA0,0,0,0,0,0,0,0,0
9D   3680 DATA0,0,0,0,0,0,0,0,0
AB   3690 DATA0,0,0,0,0,0,0,0,0
C4   3700 DATA240,240,0,128,16,0,
          128,16,768
77   3710 DATA0,128,16,0,128,16,0
          ,128,416
8D   3720 DATA16,0,128,16,0,128,1
          6,0,304
64   3730 DATA128,16,0,128,16,0,1
          28,16,432
C1   3740 DATA0,240,240,0,0,0,0,0
          ,480
E7   3750 DATA0,0,0,0,0,0,0,0,0
ED   3760 DATA0,0,0,0,0,0,0,0,0
FB   3770 DATA0,0,0,0,0,0,0,0,0
03   3780 DATA0,0,0,127,224,0,64,
          32,447
B3   3790 DATA0,64,32,0,0,0,0,0,9
          6
15   3800 DATA0,0,0,0,0,0,0,0,0
BD   3810 DATA64,32,0,64,32,0,127
          ,224,543
29   3820 DATA0,0,0,0,0,0,0,0,0
37   3830 DATA0,0,0,0,0,0,0,0,0
3C   3840 DATA0,0,0,0,0,0,0,0,0
4A   3850 DATA0,0,0,0,0,0,0,0,0
C0   3860 DATA0,0,0,112,224,0,64,
          32,432
89   3870 DATA0,64,32,0,64,32,0,6
          4,256
AB   3880 DATA32,0,64,32,0,64,32,
          0,224
EF   3890 DATA64,32,0,64,32,0,112
          ,224,528
78   3900 DATA0,0,0,0,0,0,0,0,0
86   3910 DATA0,0,0,0,0,0,0,0,0
8C   3920 DATA0,0,0,0,0,0,0,0,0
9A   3930 DATA0,0,0,0,0,0,0,0,0
5A   50000 PRINT"READING LINE #":
     L=100:FORI=49152TO52223STEP8

8B   50010 PRINTL"[UP]":ZZ=0:FORJ
     =0TO7:READZ:ZZ=ZZ+Z:POKEI+J,
     Z:NEXTJ:READZ
5B   50020 IFZ<>ZZTHENPRINT"DATA
     ERROR IN LINE"L:END
4B   50030 L=L+10:NEXTI:END
```

---

128 F-KEYS

```
10 REM ***************************
*****************
20 REM **FKEYS SWAPPER BY JOHN Y
OUNIE SEPT 87    **
30 REM **PROGRAM RESIDES AT $130
0 (DEC 4864)     **
40 REM **SOURCE CODE:- COMPUTE'S
 LABEL ASSEMBLER**
50 REM **BASIC DATA :- ICPUG'S D
ATAMAKER 128     **
60 REM **COMPUTER    :- C128 80/4
0 COLUMNS        **
70 REM ***************************
*****************
80 FAST
90 READ A:POKE 4105,A:B=B+A
100 FOR Z=1 TO 9:READ A:POKE 416
7+Z,A:B=B+A:NEXT Z
110 FOR Z=1 TO 1189:READ A:POKE
4863+Z,A:B=B+A:NEXTZ
120 IF B<> 148084 THEN PRINT"ERR
OR IN CHECKSUM":SLOW:STOP
130 SLOW:BSAVE "KEYS M/CODE",B0,
P4864 TO P6053:NEW
140 REM **INITIAL HELP SETUP**
150 DATA 9,83,89,83,32,52,56,54,
52,13
160 REM **KEY PROG**
170 DATA 169,255,141,48,208,32,1
25,255
180 DATA 68,73,83,75,32,75,69,89
190 DATA 83,32,40,74,79,72,78,32
200 DATA 89,79,85,78,73,69,32,49
210 DATA 57,56,55,41,0,169,253,1
33
220 DATA 250,169,22,133,251,169,
0,133
230 DATA 252,169,250,172,213,22,
162,1
240 DATA 32,101,255,169,7,133,25
0,169
250 DATA 23,133,251,169,250,172,
214,22
260 DATA 162,2,32,101,255,169,17
,133
270 DATA 250,169,23,133,251,169,
250,172
280 DATA 215,22,162,3,32,101,255
,169
290 DATA 24,133,250,169,23,133,2
51,169
300 DATA 250,172,216,22,162,4,32
,101
310 DATA 255,169,29,133,250,169,
23,133
320 DATA 251,169,250,172,217,22,
162,5
330 DATA 32,101,255,169,54,133,2
50,169
340 DATA 23,133,251,169,250,172,
218,22
350 DATA 162,6,32,101,255,169,64
,133
360 DATA 250,169,23,133,251,169,
250,172
370 DATA 219,22,162,7,32,101,255
,169
380 DATA 70,133,250,169,23,133,2
51,169
390 DATA 250,172,220,22,162,8,32
,101
400 DATA 255,169,81,133,250,169,
23,133
410 DATA 251,169,250,172,221,22,
162,9
420 DATA 32,101,255,169,89,133,2
50,169
430 DATA 23,133,251,169,250,172,
222,22
440 DATA 162,10,32,101,255,169,2
52,141
450 DATA 48,208,96,169,255,141,4
8,208
460 DATA 32,125,255,75,69,89,80,
65
470 DATA 68,32,75,69,89,83,32,40
480 DATA 74,79,72,78,32,89,79,85
490 DATA 78,73,69,32,49,57,56,55
500 DATA 41,0,169,98,133,250,169
,23
510 DATA 133,251,169,0,133,252,1
69,250
520 DATA 172,223,22,162,1,32,101
,255
530 DATA 169,7,133,250,169,23,13
3,251
540 DATA 169,250,172,224,22,162,
2,32
550 DATA 101,255,169,99,133,250,
169,23
560 DATA 133,251,169,250,172,225
,22,162
570 DATA 3,32,101,255,169,17,133
,250
580 DATA 169,23,133,251,169,250,
172,226
590 DATA 22,162,4,32,101,255,169
,100
600 DATA 133,250,169,23,133,251,
169,250
610 DATA 172,227,22,162,5,32,101
,255
620 DATA 169,101,133,250,169,23,
133,251
630 DATA 169,250,172,228,22,162,
6,32
640 DATA 101,255,169,106,133,250
,169,23
```

```
650 DATA 133,251,169,250,172,229
,22,162
660 DATA 7,32,101,255,169,64,133
,250
670 DATA 169,23,133,251,169,250,
172,230
680 DATA 22,162,8,32,101,255,169
,81
690 DATA 133,250,169,23,133,251,
169,250
700 DATA 172,231,22,162,9,32,101
,255
710 DATA 169,109,133,250,169,23,
133,251
720 DATA 169,250,172,232,22,162,
10,32
730 DATA 101,255,32,165,22,169,2
52,141
740 DATA 48,208,96,169,255,141,4
8,208
750 DATA 32,125,255,72,69,88,80,
65
760 DATA 68,32,75,69,89,83,32,40
770 DATA 74,79,72,78,32,89,79,85
780 DATA 78,73,69,32,49,57,56,55
790 DATA 41,0,169,118,133,250,16
9,23
800 DATA 133,251,169,0,133,252,1
69,250
810 DATA 172,233,22,162,1,32,101
,255
820 DATA 169,7,133,250,169,23,13
3,251
830 DATA 169,250,172,234,22,162,
2,32
840 DATA 101,255,169,119,133,250
,169,23
850 DATA 133,251,169,250,172,235
,22,162
860 DATA 3,32,101,255,169,17,133
,250
870 DATA 169,23,133,251,169,250,
172,236
880 DATA 22,162,4,32,101,255,169
,120
890 DATA 133,250,169,23,133,251,
169,250
900 DATA 172,237,22,162,5,32,101
,255
910 DATA 169,121,133,250,169,23,
133,251
920 DATA 169,250,172,238,22,162,
6,32
930 DATA 101,255,169,135,133,250
,169,23
940 DATA 133,251,169,250,172,239
,22,162
950 DATA 7,32,101,255,169,136,13
3,250
960 DATA 169,23,133,251,169,250,
172,240
970 DATA 22,162,8,32,101,255,169
,81
980 DATA 133,250,169,23,133,251,
169,250
990 DATA 172,231,22,162,9,32,101
,255
1000 DATA 169,147,133,250,169,23
,133,251
1010 DATA 169,250,172,242,22,162
,10,32
1020 DATA 101,255,32,165,22,32,2
02,22
1030 DATA 169,252,141,48,208,96,
169,255
1040 DATA 141,48,208,32,125,255,
78,79
1050 DATA 82,77,65,76,32,75,69,8
9
1060 DATA 83,32,40,74,79,72,78,3
2
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```
1070 DATA 89,79,85,78,73,69,32,4
9
1080 DATA 57,56,55,41,0,169,178,
133
1090 DATA 250,169,206,133,251,16
9,128,141
1100 DATA 62,3,169,250,141,63,3,
169
1110 DATA 15,133,252,169,250,172
,243,22
1120 DATA 162,1,32,101,255,169,1
85,133
1130 DATA 250,169,206,133,251,16
9,250,172
1140 DATA 244,22,162,2,32,101,25
5,169
1150 DATA 191,133,250,169,206,13
3,251,169
1160 DATA 250,172,245,22,162,3,3
2,101
1170 DATA 255,169,201,133,250,16
9,206,133
1180 DATA 251,169,250,172,246,22
,162,4
1190 DATA 32,101,255,169,208,133
,250,169
1200 DATA 206,133,251,169,250,17
2,247,22
1210 DATA 162,5,32,101,255,169,2
14,133
1220 DATA 250,169,206,133,251,16
9,250,172
1230 DATA 248,22,162,6,32,101,25
5,169
1240 DATA 218,133,250,169,206,13
3,251,169
1250 DATA 250,172,249,22,162,7,3
2,101
1260 DATA 255,169,223,133,250,16
9,206,133
1270 DATA 251,169,250,172,250,22
,162,8
1280 DATA 32,101,255,169,156,133
,250,169
1290 DATA 23,133,251,169,250,172
,251,22
1300 DATA 162,9,32,101,255,169,2
40,133
1310 DATA 250,169,206,133,251,16
9,250,172
1320 DATA 252,22,162,10,32,101,2
55,169
1330 DATA 252,141,48,208,96,160,
0,185
1340 DATA 128,250,153,0,27,200,1
92,89
1350 DATA 208,245,173,197,10,9,1
28,141
1360 DATA 197,10,169,0,141,62,3,
169
1370 DATA 27,141,63,3,169,44,141
,82
1380 DATA 27,96,169,69,141,73,27
,169
1390 DATA 70,141,74,27,96,10,10,
7
1400 DATA 5,25,10,6,11,8,9,1
1410 DATA 10,1,7,1,5,3,6,8
1420 DATA 9,1,10,1,7,1,14,1
1430 DATA 11,8,9,7,6,10,7,6
1440 DATA 4,5,8,9,5,82,213,27
1450 DATA 75,157,157,157,27,64,1
3,68
1460 DATA 204,27,75,157,157,157,
27,64
1470 DATA 13,83,195,13,68,73,210
,13
1480 DATA 82,69,78,213,13,68,211
,34
1490 DATA 34,157,32,17,17,17,17,
157
```

```
1500 DATA 157,157,157,68,214,34,
34,157
1510 DATA 32,145,145,145,145,157
,66,204
1520 DATA 27,75,157,157,157,27,6
4,13
1530 DATA 83,195,13,76,201,13,83
,67
1540 DATA 210,27,75,157,157,157,
27,64
1550 DATA 13,68,204,34,42,13,82,
213
1560 DATA 13,83,89,83,32,53,48,5
7
1570 DATA 49,13,63,42,47,65,213,
49
1580 DATA 48,13,68,193,32,83,89,
83
1590 DATA 32,53,51,50,51,13,65,6
6
1600 DATA 67,63,68,69,67,40,34,3
4
1610 DATA 41,157,157,148,148,148
,148,68
1620 DATA 63,72,197,40,41,157,14
8,148
1630 DATA 148,148,148,83,89,83,3
2,53
1640 DATA 53,53,56,13,83,89,83,3
2
1650 DATA 52,56,54,52,13
```

DESIGNER

GETTING IT ALL IN

Type in and SAVE each of the programs presented here.

You will not be able to RUN the program until you have all of the sections. These will appear over the next two months.

PROGRAM: DESIGNER BAS1

```
67   10 BL-104   :LN-50    :SA=2049

58   20 FOR L-0 TO BL:CX=0:FOR D-
     0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT
     "ERROR IN LINE";LN+(L*10):ST
     OP
40   40 NEXT L:END
D6   50 DATA 11,8,0,0,158,50,48,5
```

```
     4,49,0,0,0,32,68,229,120,827
5B   60 DATA 162,255,154,160,0,13
     2,1,162,204,189,87,8,157,51,
     3,185,1910
10   70 DATA 29,9,153,255,0,202,2
     08,2,162,1,136,208,236,198,4
     6,165,2010
A8   80 DATA 46,201,8,240,13,206,
     61,8,177,45,153,255,255,136,
     208,248,2260
67   90 DATA 240,235,132,248,160,
     188,169,153,133,249,169,128,
     162,187,134,45,2732
E0   100 DATA 162,116,134,46,76,5
     2,3,162,0,134,254,10,240,32,
     144,60,1625
5A   110 DATA 162,6,10,240,43,38,
     254,202,208,248,166,254,72,1
     89,7,1,2100
B0   120 DATA 141,1,8,104,238,78,
     3,208,222,238,79,3,208,217,1
     77,248,2173
2C   130 DATA 42,200,208,218,230,
     249,208,214,169,55,133,1,88,
     76,16,8,2115
05   140 DATA 177,248,42,200,208,
     207,230,249,208,203,240,236,
     10,240,21,176,2895
BC   150 DATA 43,162,3,10,240,26,
     38,254,202,208,248,166,254,7
     2,189,255,2370
F9   160 DATA 0,76,77,3,177,248,4
     2,200,208,229,230,249,208,22
     5,240,200,2612
EE   170 DATA 177,248,42,200,208,
     224,230,249,208,220,240,188,
     10,240,21,176,2881
85   180 DATA 56,162,6,10,240,26,
     38,254,202,208,248,166,254,7
     2,189,71,2202
DD   190 DATA 1,76,77,3,177,248,4
     2,200,208,229,230,249,208,22
     5,240,152,2565
75   200 DATA 177,248,42,200,208,
     224,230,249,208,220,240,140,
     177,248,42,200,3053
60   210 DATA 208,12,230,249,208,
     8,76,101,3,162,7,10,240,238,
     38,254,2044
B7   220 DATA 202,208,248,166,254
     ,72,189,135,1,76,77,3,139,0,
     32,133,1935
D5   230 DATA 5,165,208,6,240,76,
     1,3,169,2,136,84,7,177,16,14
     5,1440
97   240 DATA 70,101,8,160,86,4,5
     6,72,96,104,59,200,24,57,51,
     67,1215
83   250 DATA 241,226,9,10,69,144
     ,102,134,162,115,105,65,71,1
     7,176,255,1901
1B   260 DATA 41,15,119,116,202,1
     17,58,153,73,229,11,74,198,1
     3,125,230,1774
2C   270 DATA 121,141,170,48,40,5
     4,14,49,132,189,239,81,185,1
     22,44,247,1876
9E   280 DATA 120,173,201,82,138,
     248,209,36,12,78,118,197,18,
     46,68,19,1763
37   290 DATA 166,66,131,168,85,1
     52,87,106,107,128,123,50,38,
     182,92,149,1830
A1   300 DATA 232,94,29,130,60,79
     ,127,45,129,245,30,75,157,16
     4,126,31,1753
F8   310 DATA 181,34,42,62,77,95,
     242,20,53,252,93,137,212,251
     ,83,80,1914
87   320 DATA 114,233,211,124,246
     ,249,89,103,110,192,250,25,6
     1,243,244,254,2748
31   330 DATA 108,253,27,52,64,11
     3,91,88,28,55,99,22,207,215,
     21,37,1480
18   340 DATA 63,109,140,210,90,2
     24,228,100,236,47,174,33,98,
     112,135,26,2025
71   350 DATA 35,193,205,39,206,2
     16,23,97,222,227,234,151,161
     ,196,204,225,2634
A3   360 DATA 190,195,186,199,43,
     146,111,238,191,143,172,194,
     220,223,188,235,2874
E6   370 DATA 237,142,147,150,171
     ,148,213,221,158,183,203,155
     ,156,154,167,159,2764
F7   380 DATA 175,179,214,163,178
     ,180,218,231,184,217,219,187
     ,8,66,16,132,2567
0E   390 DATA 33,8,66,16,132,40,2
     00,140,248,225,79,10,33,103,
     59,155,1547
E5   400 DATA 9,14,187,43,60,203,
     88,140,16,214,113,50,141,51,
     5,132,1466
BA   410 DATA 135,60,40,132,116,2
     38,97,157,92,200,183,78,204,
     55,77,97,1961
37   420 DATA 12,200,100,64,103,3
     5,129,1,158,175,1,54,202,175
     ,140,193,1742
48   430 DATA 35,123,195,71,55,70
     ,118,226,52,163,132,209,193,
     149,57,211,2059
84   440 DATA 239,12,202,196,35,5
     4,141,239,12,122,231,194,146
     ,205,192,152,2372
D2   450 DATA 54,22,188,150,108,1
     05,26,242,89,177,178,52,138,
     179,99,104,1911
14   460 DATA 141,103,170,47,132,
     205,121,44,220,181,157,119,3
     7,133,50,46,1906
40   470 DATA 193,86,115,88,81,17
     2,240,197,246,153,158,25,41,
     25,108,221,2149
6D   480 DATA 119,37,133,50,46,19
     3,89,185,172,42,124,186,243,
     7,239,120,1985
D8   490 DATA 120,64,156,89,154,4
     7,132,207,133,156,240,201,89
     ,215,150,205,2358
9F   500 DATA 174,89,184,43,24,97
     ,8,66,16,132,33,8,66,16,132,
     40,1128
0C   510 DATA 202,81,50,117,89,14
     1,133,137,59,170,100,108,236
     ,70,124,112,1929
0C   520 DATA 188,38,92,5,156,233
     ,225,146,179,230,16,198,50,6
     8,169,148,2141
9A   530 DATA 116,131,59,115,219,
     4,70,137,220,245,134,49,145,
     121,53,189,2007
A3   540 DATA 48,67,11,36,41,44,4
     7,182,20,209,125,179,168,231
     ,18,2,1428
0D   550 DATA 217,112,25,202,195,
     67,116,229,66,43,10,70,116,2
     21,113,182,1984
21   560 DATA 200,217,80,134,246,
     68,105,71,9,163,131,86,112,4
     7,119,156,1944
14   570 DATA 136,13,203,244,2,10
     6,49,28,67,53,227,215,37,133
     ,117,165,1795
0B   580 DATA 66,107,146,176,151,
     58,235,198,128,250,0,148,39,
     1,22,233,1958
C0   590 DATA 202,132,233,165,97,
     25,13,218,118,189,110,170,24
     7,234,9,118,2280
3C   600 DATA 22,74,112,97,60,138
     ,116,27,8,167,94,253,119,150
     ,218,116,1771
09   610 DATA 184,136,37,115,146,
     151,99,145,206,123,128,151,1
     07,211,122,116,2177
D7   620 DATA 233,210,226,72,87,6
     0,141,74,63,164,120,248,18,1
     62,78,178,2134
87   630 DATA 66,54,117,4,17,57,2
     53,32,204,88,168,26,53,220,2
     31,19,1609
1B   640 DATA 104,114,48,175,76,6
     8,8,225,100,69,47,23,203,130
     ,50,78,1518
87   650 DATA 235,28,160,224,101,
     174,52,222,54,149,221,100,16
     ,46,235,142,2159
F4   660 DATA 149,119,110,218,119
     ,88,91,78,236,58,24,218,81,6
     2,234,1,1886
30   670 DATA 107,74,196,118,190,
     184,182,162,79,251,70,128,23
     3,125,103,109,2311
2E   680 DATA 8,148,34,4,77,219,7
     5,18,136,155,182,150,37,159,
     168,187,1757
73   690 DATA 81,44,253,100,45,68
     ,8,156,229,4,75,63,67,14,37,
     159,1403
99   700 DATA 176,161,196,172,59,
     49,25,33,242,70,169,217,33,1
     86,8,219,2015
28   710 DATA 76,144,209,66,134,1
     57,201,175,26,63,26,29,89,14
     2,60,20,1617
E4   720 DATA 90,7,26,63,26,29,89
     ,142,60,20,90,6,10,45,2,234,
     939
48   730 DATA 180,16,188,192,255,
     77,67,77,33,76,168,154,101,8
     3,83,117,1867
99   740 DATA 156,187,72,134,122,
     142,198,130,2,100,77,205,239
     ,247,210,15,2236
73   750 DATA 171,119,70,3,7,169,
     153,194,65,55,55,191,177,34,
     110,111,1684
EB   760 DATA 127,58,65,245,110,2
     32,225,90,162,25,234,59,37,2
     6,114,33,1842
88   770 DATA 158,163,177,212,230
     ,207,81,115,144,164,133,125,
     62,38,142,245,2396
FA   780 DATA 81,169,170,141,19,8
     7,245,84,253,90,154,188,162,
     21,247,169,2280
F0   790 DATA 162,22,151,169,207,
     10,18,45,68,66,190,253,52,66
     ,210,254,1943
AE   800 DATA 171,136,198,217,48,
     100,110,147,54,137,131,25,10
     6,209,178,76,2043
49   810 DATA 245,26,140,147,78,2
     05,74,104,165,38,54,188,30,1
     09,166,231,2000
5F   820 DATA 42,52,56,79,43,132,
     215,216,108,89,125,12,187,19
84   830 DATA 210,215,105,78,166,
     253,38,208,11,103,81,109,177
     ,108,202,173,2237
24   840 DATA 156,214,241,64,147,
     114,91,202,9,54,77,171,119,1
     8,117,90,1884
29   850 DATA 183,77,38,250,174,2
     09,66,101,16,13,74,3,27,120,
     21,67,1439
2E   860 DATA 2,155,101,19,108,17
     9,86,200,181,105,22,173,22,2
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    13,187,226,1979
D3  870 DATA 113,196,134,106,214
    ,77,35,132,155,246,213,182,7
    7,91,230,213,2414
01  880 DATA 176,91,21,171,230,7
    7,164,78,52,137,134,253,68,1
    53,103,19,1927
AF  890 DATA 51,83,42,212,202,23
    3,181,170,168,230,223,208,76
    ,168,19,49,2315
11  900 DATA 211,42,68,202,141,5
    1,153,50,195,38,85,73,150,13
    7,50,217,1863
54  910 DATA 166,90,100,203,112,
    153,87,52,140,243,72,188,111
    ,57,52,141,1967
BE  920 DATA 43,72,185,211,21,49
    ,125,48,147,76,103,116,41,16
    6,26,36,1465
BD  930 DATA 194,193,49,89,48,18
    3,76,43,83,9,212,194,129,48,
    198,48,1796
0B  940 DATA 110,59,6,167,76,96,
    76,52,105,143,77,169,214,196
    ,91,44,1681
76  950 DATA 83,48,83,61,19,51,1
    9,54,211,45,2,101,152,76,242
    ,76,1323
F7  960 DATA 180,169,150,125,50,
    131,76,166,83,46,130,101,0,1
    53,106,211,1877
4A  970 DATA 43,212,203,184,130,
    101,87,202,244,195,37,177,14
    9,112,161,105,2342
69  980 DATA 98,101,51,114,157,1
    32,195,158,152,174,152,109,1
    47,15,98,97,1950
60  990 DATA 221,77,160,246,237,
    105,30,15,36,96,220,64,166,2
    18,182,13,2086
1A  1000 DATA 38,193,179,137,132
    ,74,97,176,148,216,54,181,15
    5,94,77,171,2122
9D  1010 DATA 232,193,252,87,36,
    90,68,139,87,181,92,130,87,1
    21,87,54,1936
A2  1020 DATA 106,233,170,235,10
    ,230,93,92,207,171,146,106,2
    38,138,230,125,2530
B7  1030 DATA 92,147,87,46,213,2
    03,101,115,36,174,220,174,23
    6,155,47,52,2098
0E  1040 DATA 81,92,234,104,214,
    236,219,33,24,142,158,184,11
    7,106,119,251,2314
70  1050 DATA 174,29,84,116,35,3
    8,5,165,80,141,210,109,130,5
    1,35,245,1647
36  1060 DATA 187,52,77,191,89,1
    15,84,19,159,124,74,43,144,1
    23,246,166,1893
C0  1070 DATA 87,164,78,85,250,1
    62,86,246,23,11,130,86,246,1
    31,223,181,2189
BC  1080 DATA 49,112,191,84,93,2
    17,152,61,251,83,19,6,204,21
    6,51,226,2015
6E  1090 DATA 37,219,50,2,59,253
    ,0,0,0,0,0,0,0,0,0,0,620
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PROGRAM: DESIGNER BAS2

```
64  10 BL=104   :LN=50   :SA=3719
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
06  50 DATA 137,45,130,131,223,1
    76,156,251,226,95,128,139,17
    4,205,144,9,2369
0F  60 DATA 251,179,12,22,126,15
    ,126,194,225,124,89,25,249,2
    12,209,186,2244
58  70 DATA 225,154,68,72,95,91,
    179,26,27,129,174,29,84,5,73
    ,200,1631
29  80 DATA 202,101,133,76,77,11
    9,100,133,53,13,54,217,107,1
    05,178,123,1791
C6  90 DATA 176,158,194,229,142,
    20,13,117,83,245,127,85,28,4
    2,168,10,1837
AE  100 DATA 153,28,36,42,39,106
    ,175,47,9,73,18,194,216,194,
    222,134,1686
40  110 DATA 56,85,28,18,194,167
    ,177,133,188,113,194,70,178,
    230,149,35,2015
34  120 DATA 100,40,16,224,163,1
    8,136,223,46,195,70,141,119,
    34,249,116,1890
6C  130 DATA 226,249,67,69,53,26
    ,76,162,70,214,72,104,87,43,
    98,125,1741
4E  140 DATA 11,238,212,9,78,32,
    125,218,51,36,133,113,109,11
    5,162,196,1838
4E  150 DATA 33,88,152,166,74,16
    1,88,152,176,8,226,5,137,138
    ,100,210,1914
6D  160 DATA 21,141,138,241,173,
    98,161,91,72,176,44,179,169,
    24,184,83,1995
1D  170 DATA 22,53,67,66,176,81,
    87,13,164,88,27,16,168,104,1
    71,134,1437
31  180 DATA 54,45,33,61,105,190
    ,97,98,4,245,166,249,194,98,
    4,245,1888
D5  190 DATA 166,215,30,237,64,1
    25,162,66,87,0,145,210,138,2
    41,61,105,2052
99  200 DATA 181,195,19,23,129,1
    57,252,110,10,41,198,181,43,
    58,41,108,1746
21  210 DATA 174,254,138,43,148,
    102,121,26,181,181,75,171,22
    1,133,55,3,2026
00  220 DATA 74,58,246,24,177,47
    ,126,199,226,38,149,194,90,4
    7,3,50,1748
8C  230 DATA 209,18,148,226,55,2
    0,231,78,157,58,10,13,198,69
    ,36,213,1739
F9  240 DATA 223,251,85,193,11,9
    9,179,130,21,49,113,74,65,11
    8,18,140,1769
72  250 DATA 227,45,107,235,46,1
    00,98,55,73,191,180,72,212,1
    93,145,204,2183
CF  260 DATA 182,168,232,239,250
    ,148,110,178,214,212,10,52,1
    53,71,110,214,2543
75  270 DATA 77,40,84,252,85,198
    ,182,163,129,145,104,167,110
    ,212,168,74,2190
99  280 DATA 196,43,185,107,232,
    140,133,67,90,250,219,153,11
    ,114,215,221,2376
43  290 DATA 38,66,179,54,190,21
    6,50,53,155,135,245,167,54,7
    2,168,86,1928
24  300 DATA 157,92,184,94,155,1
    32,164,90,134,2,136,93,82,13
    6,235,88,1974
AC  310 DATA 91,255,169,131,85,2
    8,32,17,133,237,113,160,70,1
    73,109,95,1898
ED  320 DATA 191,125,128,210,109
    ,137,22,3,73,179,46,234,11,1
    70,81,190,1909
6E  330 DATA 76,26,4,93,78,197,1
    40,219,91,228,193,181,49,40,
    212,53,1880
41  340 DATA 164,171,183,105,214
    ,185,105,182,102,109,10,42,8
    ,81,80,78,1819
53  350 DATA 51,187,96,205,118,1
    47,125,109,205,16,63,83,6,20
    1,59,135,1806
6D  360 DATA 246,217,10,215,197,
    120,238,197,66,240,139,2,195
    ,58,249,69,2458
5A  370 DATA 195,34,32,87,28,34,
    192,74,9,229,77,174,28,232,1
    62,121,1708
1C  380 DATA 83,107,135,94,42,21
    ,206,139,2,178,65,62,36,227,
    7,60,1464
4F  390 DATA 56,100,87,71,57,120
    ,98,230,145,233,206,139,134,
    21,122,104,1923
E6  400 DATA 87,58,44,168,81,170
    ,178,176,176,166,17,204,110,
    174,200,230,2239
AC  410 DATA 143,13,228,130,124,
    72,36,196,5,235,27,58,149,52
    ,130,126,1724
86  420 DATA 168,145,44,26,21,21
    5,139,1,54,144,22,70,15,211,
    175,22,1472
3E  430 DATA 154,141,134,117,226
    ,223,171,169,242,231,18,44,2
    3,67,200,185,2345
AD  440 DATA 105,70,221,180,39,1
    55,202,53,157,180,39,155,206
    ,72,168,86,2088
68  450 DATA 38,210,173,140,224,
    100,138,65,105,150,14,253,17
    3,245,219,88,2335
29  460 DATA 72,223,56,182,176,1
    66,98,6,152,149,253,170,179,
    140,133,164,2319
2B  470 DATA 220,174,9,4,227,117
    ,143,46,64,227,223,146,245,1
    40,91,241,2325
68  480 DATA 101,195,34,197,57,1
    87,199,190,175,3,64,78,101,4
    6,247,26,1900
1D  490 DATA 166,64,164,23,1,117
    ,56,25,150,109,152,91,72,214
    ,118,214,1736
FF  500 DATA 62,35,75,79,12,158,
    48,26,207,197,226,184,10,20,
    169,101,1609
1C  510 DATA 192,93,65,44,208,90
    ,189,207,133,39,143,73,21,24
    4,241,157,2139
79  520 DATA 60,146,120,254,175,
    39,138,0,95,80,90,147,19,120
    ,254,80,1817
A7  530 DATA 205,75,106,190,223,
    56,182,181,17,190,187,107,86
    ,152,144,160,2261
88  540 DATA 181,62,105,77,227,2
    45,155,180,161,154,150,251,1
    74,213,65,117,2517
FA  550 DATA 242,142,22,166,144,
    74,246,240,185,87,59,196,178
    ,111,38,229,2359
89  560 DATA 252,161,155,189,62,
    144,213,59,52,140,52,107,192
    ,133,98,161,2170
31  570 DATA 159,33,117,242,159,
    72,88,194,226,151,42,95,137,
    119,245,75,2154
84  580 DATA 106,69,21,25,55,120
    ,247,149,25,53,44,52,178,231
    ,116,9,1500
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83  590 DATA 209,164,229,151,197
    ,66,100,138,113,25,3,111,141
    ,254,18,209,2128
26  600 DATA 164,229,151,197,66,
    100,143,3,92,169,60,41,196,1
    00,4,20,1735
6B  610 DATA 156,178,248,215,51,
    35,239,127,180,183,3,48,73,2
    05,208,39,2188
BC  620 DATA 0,140,150,210,112,5
    0,70,162,17,60,46,90,65,181,
    222,65,1640
FF  630 DATA 76,101,178,192,4,22
    9,227,12,185,163,49,161,246,
    158,42,122,2145
18  640 DATA 95,17,44,208,90,157
    ,184,148,96,181,62,124,69,20
    ,201,73,1769
B9  650 DATA 203,240,24,37,100,4
    ,50,23,91,180,62,40,93,110,9
    6,210,1563
79  660 DATA 194,89,160,177,229,
    30,253,72,49,114,210,42,40,3
    6,107,55,1857
30  670 DATA 106,196,213,106,55,
    93,169,172,8,158,111,40,214,
    22,208,242,2113
AF  680 DATA 205,86,143,143,228,
    107,59,104,123,230,176,35,75
    ,9,230,243,2196
26  690 DATA 75,235,59,105,221,9
    7,109,35,89,187,93,114,143,1
    14,55,93,1824
F8  700 DATA 174,187,198,140,19,
    142,130,21,20,20,21,127,111,
    104,147,69,1630
28  710 DATA 246,166,70,212,113,
    145,194,128,204,163,185,106,
    61,38,55,253,2339
4A  720 DATA 38,52,213,5,203,73,
    111,207,114,178,54,40,232,88
    ,82,136,1826
91  730 DATA 237,120,87,169,56,1
    78,173,207,175,146,186,17,33
    ,143,20,64,2011
C2  740 DATA 141,135,30,97,205,1
    36,224,141,71,17,0,54,234,35
    ,46,56,1622
34  750 DATA 198,160,159,164,230
    ,5,212,129,243,30,39,48,40,9
    2,115,103,1967
72  760 DATA 133,37,54,4,56,42,3
    6,21,121,51,122,72,175,166,1
    05,175,1370
6F  770 DATA 36,226,255,36,67,19
    3,106,124,198,147,54,196,217
    ,163,97,235,2350
B8  780 DATA 201,155,55,16,210,2
    1,228,205,155,52,121,171,201
    ,155,55,16,2017
83  790 DATA 212,117,228,205,27,
    117,94,76,209,198,137,32,72,
    11,0,144,1879
FB  800 DATA 238,222,196,2,10,6,
    217,240,145,12,56,85,57,185,
    230,11,1912
B4  810 DATA 190,195,198,148,204
    ,196,8,217,66,183,87,213,12,
    165,245,67,2394
11  820 DATA 41,125,80,202,13,17
    3,168,39,71,110,22,90,36,52,
    84,66,1372
F0  830 DATA 65,106,124,150,248,
    156,125,176,122,74,140,132,3
    1,136,162,116,2063
65  840 DATA 118,196,139,133,141
    ,70,179,118,152,216,67,154,1
    41,215,105,141,2205
CF  850 DATA 8,241,39,33,192,120
    ,139,42,2,73,114,58,226,250,
    130,212,1879
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75  860 DATA 214,205,154,63,138,
    25,184,134,137,212,220,9,230
    ,243,60,42,2270
C3  870 DATA 25,127,11,126,92,21
    0,229,78,111,73,142,84,56,12
    9,253,99,1845
E6  880 DATA 52,138,117,229,205,
    72,102,15,234,242,230,215,73
    ,143,250,82,2399
C5  890 DATA 102,252,89,102,111,
    197,150,102,252,89,108,85,15
    5,150,92,218,2254
91  900 DATA 233,9,187,229,205,1
    74,88,114,230,215,44,169,115
    ,69,69,4,2154
69  910 DATA 38,42,81,91,161,195
    ,78,70,73,143,252,56,42,70,1
    46,8,1546
A4  920 DATA 218,72,47,23,145,11
    4,211,48,114,156,88,153,145,
    81,24,116,1755
0C  930 DATA 84,73,190,34,211,19
    ,163,181,182,114,237,68,10,2
    26,245,21,2058
BB  940 DATA 196,138,58,156,34,1
    98,92,78,162,86,233,112,122,
    53,127,62,1907
F3  950 DATA 33,94,66,31,116,39,
    72,42,254,203,137,212,87,7,1
    63,86,1642
7F  960 DATA 38,180,249,157,192,
    18,82,81,230,132,56,77,179,1
    51,107,30,1959
A8  970 DATA 84,42,218,136,211,8
    ,85,221,17,169,16,173,37,31,
    173,141,1762
01  980 DATA 165,100,248,72,84,1
    97,30,109,77,164,43,7,71,155
    ,235,107,1864
4F  990 DATA 132,105,80,34,81,30
    ,249,250,92,197,54,153,57,85
    ,97,141,1837
A0  1000 DATA 41,144,169,127,178
    ,83,202,11,108,58,50,180,180
    ,44,98,169,1842
7A  1010 DATA 134,145,57,90,192,
    207,120,35,40,93,103,46,213,
    115,95,117,1802
56  1020 DATA 156,187,69,91,184,
    148,111,243,91,81,168,39,69,
    118,82,108,1945
33  1030 DATA 253,2,40,201,18,24
    ,216,194,180,59,23,121,15,12
    5,80,198,1749
47  1040 DATA 112,51,44,54,134,3
    5,84,49,139,245,136,144,199,
    143,36,226,1831
4D  1050 DATA 145,7,53,29,9,80,1
    58,176,33,88,224,107,133,79,
    45,26,1392
65  1060 DATA 31,109,15,140,102,
    234,36,237,143,3,51,83,5,95,
    218,20,1522
97  1070 DATA 90,51,165,9,160,82
    ,149,111,178,66,125,16,193,1
    05,168,38,1706
C0  1080 DATA 91,79,150,168,198,
    105,196,203,105,136,30,110,1
    16,94,110,188,2079
DF  1090 DATA 94,124,34,162,24,4
    5,0,0,0,0,0,0,0,0,0,0,483
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PROGRAM: DESIGNER BAS3

```
DF  10 BL=104   :LN=50   :SA=5389
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
27  50 DATA 61,53,172,218,163,12
    5,106,141,80,76,182,146,176,
    27,23,124,1873
E1  60 DATA 210,47,55,52,139,81,
    80,76,182,146,176,28,219,243
    ,84,174,1992
1F  70 DATA 85,191,54,172,213,50
    ,5,21,146,138,43,33,17,89,14
    ,38,1309
67  80 DATA 91,74,185,194,49,147
    ,96,65,57,233,134,181,94,9,1
    2,83,1704
72  90 DATA 3,233,159,10,27,166,
    182,97,194,50,225,194,1,30,1
    64,195,1930
F5  100 DATA 6,36,227,6,53,188,6
    4,175,135,6,160,153,109,34,1
    14,24,1490
22  110 DATA 60,48,10,183,71,74,
    217,58,112,153,109,40,3,32,1
    81,29,1380
6A  120 DATA 214,91,25,174,70,16
    6,22,104,212,196,24,137,141,
    71,117,151,1915
6B  130 DATA 102,107,155,100,194
    ,205,182,76,64,85,25,163,8,1
    07,162,2,1737
87  140 DATA 236,108,218,159,68,
    62,137,137,225,128,207,78,13
    9,11,89,232,2234
A1  150 DATA 147,92,136,96,58,15
    7,54,64,74,233,42,4,56,154,2
    09,81,1657
53  160 DATA 2,159,31,68,39,122,
    133,91,247,239,220,76,222,14
    5,223,1,2018
CD  170 DATA 58,166,36,43,21,136
    ,207,161,118,17,176,157,137,
    235,38,184,1890
5F  180 DATA 46,195,71,211,91,87
    ,126,1,226,4,126,34,107,26,2
    20,112,1683
86  190 DATA 106,21,111,178,71,2
    28,47,8,176,46,25,220,241,20
    ,72,54,1624
54  200 DATA 242,120,91,103,46,2
    12,150,29,112,193,209,42,141
    ,28,224,196,2138
F3  210 DATA 219,170,44,77,116,2
    08,173,37,20,118,186,186,161
    ,40,80,121,1956
9F  220 DATA 151,13,85,24,42,254
    ,209,153,88,83,226,163,17,16
    ,45,11,1580
98  230 DATA 114,111,156,11,81,1
    40,205,35,89,184,98,220,155,
    250,205,195,2249
86  240 DATA 104,234,35,110,90,2
    16,234,125,185,105,26,205,19
    5,189,40,205,2298
89  250 DATA 162,53,155,135,177,
    13,5,162,77,236,69,225,139,1
    22,117,68,1915
F0  260 DATA 98,53,155,134,40,20
    1,184,45,18,111,2,223,98,71,
    2,222,1657
7B  270 DATA 165,116,98,34,229,1
    61,70,77,243,185,106,52,166,
    105,163,168,2138
D2  280 DATA 133,99,98,253,124,8
    3,104,86,210,47,213,226,109,
    155,99,98,2137
52  290 DATA 154,27,54,218,69,70
    ,212,113,170,33,90,248,191,9
    2,164,218,2123
4B  300 DATA 23,132,95,173,242,1
    09,155,107,226,154,27,55,192
    ,4,64,176,1934
B5  310 DATA 110,246,70,14,32,81
    ,139,135,26,47,9,76,179,186,
    145,180,1675
96  320 DATA 209,128,238,20,166,
    6,166,201,9,252,145,87,137,7
    5,235,207,2201
67  330 DATA 57,131,2,28,23,165,
    119,195,132,168,5,74,115,115
    ,162,149,1640
20  340 DATA 5,205,215,139,5,95,
    216,83,37,21,161,217,33,62,1
    40,44,1678
67  350 DATA 222,109,124,82,226,
    231,194,41,88,126,119,98,149
    ,33,205,242,2289
D5  360 DATA 139,135,188,100,34,
    152,92,180,137,168,77,207,13
    4,161,191,249,2344
76  370 DATA 121,58,3,60,132,244
    ,37,4,165,207,162,176,252,21
    4,177,74,2086
29  380 DATA 144,230,145,138,89,
    188,208,209,121,177,177,75,1
    39,155,24,20,2239
17  390 DATA 154,154,84,62,108,2
    0,88,198,73,100,134,140,94,4
    9,144,33,1635
F6  400 DATA 165,82,54,151,13,16
    4,94,6,102,90,56,42,254,192,
    35,202,1702
88  410 DATA 152,87,204,74,211,7
    0,34,24,45,56,73,229,17,20,1
    96,233,1725
93  420 DATA 173,102,136,139,245
    ,17,22,194,133,124,159,171,2
    06,36,86,140,2083
F5  430 DATA 7,84,166,0,194,211,
    165,169,211,80,210,95,27,202
    ,49,16,1886
FD  440 DATA 193,105,89,162,34,1
    63,161,78,80,223,64,39,209,0
    ,37,134,1771
F9  450 DATA 169,170,116,118,150
    ,104,211,197,196,52,33,83,27
    ,42,13,49,1730
C6  460 DATA 125,124,190,95,126,
    66,176,90,72,173,26,180,169,
    141,141,0,1894
18  470 DATA 216,248,17,98,107,2
    33,172,124,75,27,36,59,234,1
    34,63,129,1972
DF  480 DATA 153,97,169,157,103,
    46,210,33,167,162,171,89,87,
    86,54,52,1836
CC  490 DATA 76,181,42,209,46,17
    8,42,191,170,148,201,65,172,
    134,180,109,2144
EC  500 DATA 155,75,88,212,170,2
    04,106,252,155,132,175,106,1
    78,124,18,189,2339
22  510 DATA 170,20,101,216,140,
    213,79,101,132,0,243,76,107,
    174,100,93,1965
E9  520 DATA 50,202,166,84,165,5
    0,249,166,40,203,177,114,176
    ,84,18,93,2037
4A  530 DATA 76,93,189,88,253,80
    ,196,161,106,170,143,205,81,
    165,42,142,2190
88  540 DATA 85,81,233,200,130,1
    8,21,78,36,42,157,39,183,249
    ,197,25,1774
1C  550 DATA 118,37,11,84,44,13,
    57,151,144,85,253,153,0,154,
    43,33,1380
78  560 DATA 9,120,20,186,209,12
    1,11,170,191,12,226,172,149,
    97,42,149,1884
20  570 DATA 87,10,166,77,206,64
    ,105,137,140,106,170,212,17,
    154,161,60,1872
6E  580 DATA 13,84,4,136,131,96,
    169,68,188,162,249,235,167,1
    1,167,80,1960
38  590 DATA 190,127,223,147,53,
    38,164,98,201,131,139,86,74,
    141,89,19,1920
CB  600 DATA 132,198,150,152,150
    ,212,78,243,18,216,88,159,19
    7,86,179,12,2270
D3  610 DATA 22,154,130,253,99,3
    7,21,231,106,124,12,203,9,19
    3,112,128,1834
E4  620 DATA 118,221,167,36,38,1
    80,190,122,178,154,136,39,12
    9,170,128,237,2243
EE  630 DATA 149,40,63,69,242,53
    ,214,70,22,170,174,82,176,20
    4,176,144,2048
91  640 DATA 182,4,224,184,66,10
    8,44,9,224,106,160,45,98,66,
    73,169,1762
EE  650 DATA 27,152,177,34,216,1
    54,148,156,36,11,78,128,47,1
    56,193,18,1731
BD  660 DATA 5,167,42,8,72,22,15
    6,187,68,129,105,203,232,72,
    22,156,1646
65  670 DATA 171,172,159,22,129,
    19,24,2,59,141,84,207,48,82,
    178,139,1636
A0  680 DATA 185,47,240,212,74,1
    40,75,162,106,16,146,54,194,
    103,171,10,1935
18  690 DATA 144,75,11,100,63,17
    8,251,68,189,245,55,14,36,14
    3,174,18,1764
64  700 DATA 187,191,214,157,92,
    149,91,43,146,169,53,116,251
    ,8,134,48,2049
04  710 DATA 60,254,109,101,123,
    106,148,136,88,180,252,221,1
    87,76,172,141,2354
D6  720 DATA 71,68,108,112,185,1
    78,58,218,235,10,232,198,108
    ,80,158,16,2035
C0  730 DATA 140,68,67,253,199,2
    0,73,221,34,106,19,104,201,2
    32,199,50,1986
E0  740 DATA 187,78,136,125,26,1
    17,195,7,13,16,202,180,235,1
    34,170,29,1850
02  750 DATA 121,78,155,70,215,3
    6,34,181,210,226,196,107,62,
    197,120,226,2234
FF  760 DATA 57,63,66,241,207,11
    ,92,229,218,136,24,204,173,1
    41,78,23,1963
6E  770 DATA 55,58,43,43,167,84,
    174,113,34,178,176,245,94,23
    0,207,27,1928
B3  780 DATA 235,132,111,173,81,
    185,134,138,135,98,236,207,1
    51,54,122,140,2332
38  790 DATA 77,124,215,116,121,
    171,168,196,169,205,109,70,3
    4,151,155,73,2154
EE  800 DATA 69,66,103,94,37,127
    ,177,162,253,102,225,196,112
    ,69,77,164,2033
87  810 DATA 22,149,64,156,173,1
    13,29,225,53,250,224,238,218
    ,239,171,145,2469
FF  820 DATA 234,134,17,80,171,2
    10,210,45,89,191,246,83,93,1
    87,118,191,2299
AB  830 DATA 127,183,110,193,60,
    233,73,134,157,164,91,11,74,
    162,147,40,1959
75  840 DATA 237,218,169,62,18,2
    40,60,210,129,94,69,230,130,
    15,8,210,2099
08  850 DATA 152,34,165,18,237,1
    10,201,9,53,35,115,22,244,23
    9,200,84,1918
A7  860 DATA 251,132,50,0,153,15
    4,117,59,106,93,168,233,218,
    182,119,192,2227
37  870 DATA 130,217,15,2,9,70,1
    63,81,165,227,106,103,132,22
    6,249,19,1914
80  880 DATA 30,222,9,18,187,42,
    83,98,70,108,209,205,47,145,
    40,44,1557
E0  890 DATA 21,5,178,66,126,162
    ,149,160,20,169,212,98,194,1
    01,89,95,1845
10  900 DATA 255,210,137,72,112,
    196,232,174,196,224,184,80,1
    19,109,66,119,2485
A6  910 DATA 1,54,38,55,143,26,1
    4,108,204,122,161,247,51,34,
    62,144,1464
DC  920 DATA 85,253,138,152,149,
    32,164,67,205,151,54,165,241
    ,140,164,254,2414
D8  930 DATA 73,131,191,41,137,4
    0,218,178,12,101,39,77,104,5
    7,164,28,1591
86  940 DATA 185,181,1,217,209,1
    05,193,229,236,104,100,70,10
    8,6,148,195,2287
A1  950 DATA 127,223,157,71,246,
    166,52,95,108,125,132,154,14
    5,185,139,136,2261
38  960 DATA 152,137,135,206,34,
    68,157,98,108,209,205,195,23
    ,222,42,158,2149
65  970 DATA 253,27,111,181,209,
    187,123,65,26,71,189,178,161
    ,137,11,98,2027
74  980 DATA 187,43,59,14,217,22
    5,44,219,19,90,209,205,43,41
    ,55,16,1686
B0  990 DATA 241,84,136,205,145,
    72,2,53,214,38,106,243,227,2
    06,27,201,2200
F1  1000 DATA 52,244,164,230,69,
    48,144,170,112,17,113,97,38,
    168,34,160,1860
DB  1010 DATA 152,93,133,65,11,5
    4,147,27,56,115,117,36,188,9
    8,168,147,1607
C1  1020 DATA 66,74,123,242,122,
    69,0,142,195,85,142,52,173,1
    79,228,22,1914
DD  1030 DATA 109,46,173,104,230
    ,151,23,86,80,120,170,22,111
    ,215,218,209,2067
D7  1040 DATA 113,125,118,45,20,
    159,94,59,77,115,179,106,162
    ,53,246,180,1851
AF  1050 DATA 57,168,215,98,208,
    241,35,94,59,67,35,172,236,2
    18,169,5,2077
22  1060 DATA 233,93,137,209,93,
    216,42,82,108,63,197,243,54,
    142,167,78,2157
25  1070 DATA 154,67,171,91,87,1
    71,41,171,172,64,143,121,99,
    15,40,152,1759
46  1080 DATA 246,240,168,41,178
    ,191,23,108,221,58,154,138,1
    05,14,185,106,2176
2C  1090 DATA 245,223,171,194,77
    ,72,0,0,0,0,0,0,0,0,0,982
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PROGRAM: DESIGNER BAS4

```
DD  10 BL=104   :LN=50    :SA=7059
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
D5  50 DATA 220,209,153,71,20,50
    ,202,38,152,11,52,228,50,209
    ,199,232,2096
81  60 DATA 107,161,126,176,95,6
    8,93,64,65,9,193,112,132,203
    ,216,201,2021
3E  70 DATA 232,72,85,60,22,241,
    151,18,22,192,176,88,201,40,
    72,85,1757
A2  80 DATA 60,20,195,47,7,118,2
    09,76,149,146,18,241,40,171,
    83,47,1627
A0  90 DATA 16,74,191,75,197,82,
    173,100,188,144,171,90,112,1
    48,238,9,2008
3F  100 DATA 206,110,240,182,48,
    94,149,216,79,229,54,203,174
    ,218,180,82,2464
DE  110 DATA 158,146,253,53,221,
    139,160,170,110,25,54,183,42
    ,49,116,158,2037
F8  120 DATA 140,238,187,202,21,
    198,71,169,224,212,248,162,1
    6,173,234,93,2588
6F  130 DATA 28,223,25,136,106,9
    5,103,16,46,91,100,249,177,1
    73,163,167,1898
FD  140 DATA 1,130,102,153,4,91,
    34,203,49,44,43,58,205,179,1
    22,245,1663
59  150 DATA 235,253,42,246,197,
    144,151,140,189,42,157,22,95
    ,155,22,131,2221
E7  160 DATA 83,34,133,170,203,2
    12,201,166,32,83,240,37,42,5
    0,170,55,1911
69  170 DATA 210,46,94,188,83,22
    9,223,213,45,134,138,19,40,2
    47,170,55,2134
94  180 DATA 42,17,156,13,214,16
    0,166,74,45,18,105,242,224,2
    18,1,55,1750
83  190 DATA 176,96,70,181,54,13
    4,140,136,165,30,232,149,71,
    198,36,33,1901
01  200 DATA 165,132,230,50,229,
    220,52,78,63,133,96,77,40,17
    0,212,116,2063
DC  210 DATA 61,73,66,202,71,11,
    85,27,247,239,162,162,107,31
    ,28,105,1677
43  220 DATA 108,123,162,41,70,1
    40,19,152,203,151,143,122,93
    ,53,205,202,1987
8D  230 DATA 168,220,168,70,11,1
    23,119,145,133,94,39,169,171
    ,12,203,64,1909
5B  240 DATA 77,151,117,137,191,
    7,240,168,201,168,145,162,69
    ,189,187,18,2227
6B  250 DATA 33,187,201,69,120,1
    86,85,162,120,25,145,241,196
    ,205,142,72,2189
28  260 DATA 117,85,107,46,18,15
    3,97,34,27,184,59,182,149,18
    ,39,93,1408
9A  270 DATA 158,156,156,134,46,
    190,80,26,167,77,74,13,101,1
    6,48,39,1481
73  280 DATA 21,41,215,120,214,8
    1,53,205,242,53,41,81,34,75,
    179,211,1866
BB  290 DATA 147,146,129,34,19,6
    0,70,208,8,33,173,0,78,204,2
    44,132,1685
C6  300 DATA 23,93,227,90,68,215
    ,55,104,213,245,41,100,102,2
    41,48,203,2068
6B  310 DATA 201,84,215,136,42,1
    06,195,34,242,64,1,220,214,2
    36,22,49,2061
9D  320 DATA 252,198,137,44,218,
    101,197,79,34,148,76,91,133,
    171,75,157,2111
71  330 DATA 86,152,241,33,98,19
    4,28,220,140,120,152,183,9,9
    ,187,84,1936
7D  340 DATA 28,145,82,106,70,23
    0,116,197,46,37,148,198,63,1
    8,153,120,1757
55  350 DATA 178,164,181,83,39,2
    15,138,85,171,31,79,82,82,15
    4,135,166,1983
19  360 DATA 188,208,147,245,122
    ,107,204,23,135,42,175,127,1
    4,18,157,154,2066
BB  370 DATA 163,79,85,26,17,115
    ,185,38,195,127,134,39,5,194
    ,152,195,1749
0C  380 DATA 100,162,188,68,188,
    75,163,45,184,25,23,98,168,2
    41,85,28,1841
B4  390 DATA 220,155,106,170,242
    ,240,148,203,100,133,85,86,1
    48,170,171,65,2442
B1  400 DATA 112,148,139,168,38,
    111,203,101,199,170,91,15,24
    1,102,176,95,2109
CD  410 DATA 150,38,241,31,202,1
    01,68,205,75,13,19,86,255,22
    6,162,87,1959
51  420 DATA 205,150,94,187,255,
    202,164,95,157,114,143,225,8
    1,61,119,141,2393
52  430 DATA 18,32,6,10,249,158,
    16,2,70,53,158,123,50,128,23
    2,102,1407
A3  440 DATA 121,161,93,111,5,23
    0,65,158,102,152,55,134,53,1
    10,61,82,1693
95  450 DATA 192,60,86,144,12,19
    1,16,18,243,73,217,44,52,72,
    179,88,1687
4F  460 DATA 130,190,103,172,102
    ,104,50,7,24,241,227,79,151,
    227,137,71,2015
3E  470 DATA 184,219,149,8,162,5
    0,255,171,206,80,211,159,57,
    32,42,45,2030
0A  480 DATA 36,103,37,185,50,70
    ,168,162,50,241,191,156,84,9
    0,72,210,1905
EA  490 DATA 153,98,142,124,57,1
    52,212,113,140,203,102,10,2,
    165,59,19,1751
7F  500 DATA 70,49,225,139,239,2
    9,90,137,87,110,210,85,108,1
    74,70,173,1995
6B  510 DATA 109,9,54,168,159,9,
    149,132,140,159,9,17,114,208
    ,144,109,1689
B5  520 DATA 32,39,51,204,30,240
    ,130,70,199,75,12,91,210,170
    ,68,50,1671
91  530 DATA 42,35,131,76,73,221
    ,53,69,77,164,131,187,104,24
    7,196,8,1814
5B  540 DATA 242,143,136,247,22,
    21,61,140,72,225,68,101,70,1
    50,137,56,1891
41  550 DATA 4,90,237,104,106,14
    2,21,65,59,235,108,104,156,1
    14,139,12,1696
AC  560 DATA 106,241,42,118,9,10
    6,189,69,54,54,191,146,82,76
    ,82,214,1779
6B  570 DATA 201,201,75,152,104,
    215,214,212,105,108,57,152,1
    48,83,99,105,2231
0A  580 DATA 139,190,141,124,173
    ,46,97,198,151,152,204,72,19
    1,47,184,25,2134
C0  590 DATA 203,131,187,104,157
    ,245,176,149,59,19,144,231,1
    34,78,94,154,2265
72  600 DATA 229,229,175,39,47,7
    7,114,242,215,147,151,166,18
    5,121,107,129,2373
C4  610 DATA 4,207,171,189,80,17
    0,21,120,14,231,41,117,129,1
    70,103,213,1980
A9  620 DATA 203,151,189,105,118
    ,174,246,65,179,3,132,213,23
    9,4,225,250,2496
F3  630 DATA 152,104,190,247,240
    ,51,123,226,84,13,66,131,99,
    12,148,98,1984
45  640 DATA 54,229,171,205,6,19
    9,100,7,99,83,105,144,108,0,
    72,236,1818
C6  650 DATA 166,241,215,174,85,
    191,54,157,93,83,110,221,177
    ,154,229,178,2528
D6  660 DATA 186,160,99,53,201,5
    3,117,64,186,206,93,164,67,7
    ,71,2,1729
3F  670 DATA 223,100,12,11,126,1
    08,29,26,128,34,185,49,118,2
    53,251,247,1900
86  680 DATA 198,183,1,222,5,115
    ,154,241,109,130,218,171,157
    ,103,46,210,2263
EA  690 DATA 33,170,4,228,106,18
    5,175,99,154,128,53,84,106,2
    ,67,145,1739
F9  700 DATA 42,242,93,76,246,65
    ,222,174,140,202,194,1,220,1
    37,78,99,2231
3C  710 DATA 3,120,90,162,236,11
    8,121,179,212,106,79,148,132
    ,96,10,183,1995
A8  720 DATA 117,156,187,92,219,
    186,37,130,163,156,136,103,1
    68,222,104,54,2230
7C  730 DATA 33,136,192,95,64,40
    ,204,226,4,4,113,123,44,54,5
    1,119,1502
05  740 DATA 162,142,20,69,117,5
    6,143,5,57,204,227,45,174,16
    8,225,85,1899
50  750 DATA 104,39,157,16,198,7
    ,154,36,49,140,139,168,40,54
    ,11,198,1510
28  760 DATA 196,214,180,124,74,
    150,154,202,13,45,82,150,38,
    230,124,140,2116
40  770 DATA 146,164,229,166,38,
    105,93,84,76,210,184,204,129
    ,86,146,248,2308
73  780 DATA 168,105,216,205,57,
    62,85,124,190,53,83,241,165,
    59,53,18,1884
6D  790 DATA 106,70,230,66,77,18
    5,149,12,90,213,215,213,10,2
    45,66,211,2158
88  800 DATA 133,64,17,170,76,93
    ,230,174,163,81,244,93,84,11
    3,148,106,1989
E8  810 DATA 197,213,71,25,70,17
    2,93,84,113,148,106,197,213,
    71,25,70,1868
C4  820 DATA 172,110,88,216,52,2
    2,209,132,240,173,178,51,200
    ,84,18,217,2162
75  830 DATA 86,233,112,50,69,57
    ,52,184,177,177,131,203,143,
    112,209,152,2147
3A  840 DATA 216,241,250,198,180
```

```
      ,26,189,115,14,32,127,36,218
      ,21,28,22,1913
58    850 DATA 132,38,157,239,47,1
      80,103,191,94,213,241,140,23
      8,36,201,43,2293
19    860 DATA 104,211,19,228,73,1
      55,124,233,133,28,185,177,16
      5,45,124,74,2078
55    870 DATA 129,176,80,108,65,1
      05,86,192,35,238,182,106,86,
      131,87,167,1973
2A    880 DATA 33,207,10,19,226,17
      ,19,83,196,84,82,16,130,95,4
      6,203,1466
5B    890 DATA 14,5,20,228,163,33,
      170,213,131,187,107,233,193,
      127,81,198,2103
87    900 DATA 81,240,95,212,113,1
      48,124,23,245,28,101,31,5,25
      3,71,25,1795
6F    910 DATA 70,220,177,176,110,
      45,163,33,8,37,114,236,92,21
      4,217,25,1937
93    920 DATA 228,41,64,117,226,2
      17,140,73,120,196,37,78,196,
      230,92,104,2159
E7    930 DATA 193,252,199,232,107
      ,172,106,241,167,128,118,161
      ,108,2,113,81,2380
DD    940 DATA 193,104,66,216,132,
      211,188,111,241,243,194,235,
      194,122,49,157,2656
76    950 DATA 176,72,124,214,204,
      195,25,25,35,38,111,115,166,
      23,210,230,1963
DE    960 DATA 215,50,212,80,108,1
      20,148,103,222,14,237,160,38
      ,253,172,201,2333
7F    970 DATA 82,150,38,195,130,1
      31,93,128,155,246,225,42,80,
      107,65,49,1916
3C    980 DATA 82,138,130,177,54,8
      6,166,27,172,109,76,145,82,1
      47,97,234,1922
63    990 DATA 98,186,183,90,150,3
      7,65,15,124,10,34,113,124,16
      4,44,77,1514
43    1000 DATA 90,15,46,24,190,24
      7,149,135,177,55,40,216,114,
      164,38,239,1939
41    1010 DATA 26,64,185,166,229,
      30,98,168,230,239,26,140,76,
      123,120,89,2009
41    1020 DATA 182,38,229,28,210,
      226,155,188,120,170,21,60,57
      ,165,66,15,1930
89    1030 DATA 17,161,138,100,161
      ,84,112,176,187,128,59,17,42
      ,50,81,84,1597
FF    1040 DATA 53,166,72,171,198,
      205,86,140,94,51,138,180,74,
      242,50,173,2093
18    1050 DATA 143,94,85,85,171,2
      48,25,220,43,116,53,41,90,17
      ,40,37,1508
C5    1060 DATA 21,85,54,30,166,59
      ,171,117,169,168,44,137,178,
      181,35,186,1801
A7    1070 DATA 198,212,151,44,136
      ,44,2,236,82,214,221,224,119
      ,43,14,185,2125
3D    1080 DATA 72,15,210,17,116,9
      2,203,149,24,211,200,68,32,1
      49,42,114,1714
81    1090 DATA 183,67,82,167,37,4
      6,0,0,0,0,0,0,0,0,0,0,582
```

PROGRAM: DESIGNER BASS

```
F0    10 BL=104  :LN=50   :SA=8729
58    20 FOR L=0 TO BL:CX=0:FOR D=
      0 TO 15:READ A:CX=CX+A:POKE
      SA+L*16+D,A:NEXT D
A5    30 READ A:IF A><CX THENPRINT
      "ERROR IN LINE";LN+(L*10):ST
      OP
40    40 NEXT L:END
D5    50 DATA 97,201,97,233,198,14
      6,195,203,245,24,204,141,89,
      126,145,77,2421
FA    60 DATA 141,166,45,167,92,19
      5,147,154,156,105,57,165,167
      ,128,70,232,2187
09    70 DATA 81,147,194,102,63,19
      3,100,87,98,98,191,193,100,8
      7,112,119,1965
DB    80 DATA 109,1,21,162,73,162,
      202,221,13,75,16,52,186,195,
      28,50,1566
43    90 DATA 176,244,186,195,27,1
      4,63,69,72,49,161,26,64,107,
      162,230,1845
6F    100 DATA 235,12,121,134,158,
      42,141,141,8,212,99,66,9,82,
      167,247,1874
DB    110 DATA 12,18,20,194,1,222,
      89,62,165,176,245,204,200,19
      8,7,148,1961
8E    120 DATA 128,152,201,224,69,
      187,209,173,64,185,37,61,47,
      53,115,50,1955
2F    130 DATA 49,129,33,235,21,19
      8,22,230,33,9,138,255,7,16,1
      63,9,1547
BB    140 DATA 223,91,46,83,223,25
      2,161,50,163,91,75,67,222,16
      1,151,150,2209
C2    150 DATA 49,152,146,171,96,8
      8,191,16,51,88,19,105,212,11
      3,33,133,1663
9F    160 DATA 6,184,186,171,70,17
      3,255,12,69,116,32,238,218,1
      98,132,108,2168
93    170 DATA 54,64,227,66,36,211
      ,210,154,172,105,108,123,149
      ,152,209,133,2173
5D    180 DATA 86,216,205,35,98,68
      ,124,64,124,109,220,118,45,1
      05,80,170,1867
1C    190 DATA 221,146,7,241,63,17
      ,131,177,243,99,120,57,17,23
      ,185,130,1877
5B    200 DATA 57,209,26,102,71,99
      ,120,53,84,69,232,158,97,22,
      29,46,1474
0C    210 DATA 168,68,186,211,12,8
      2,173,6,175,73,167,191,195,1
      31,245,183,2266
E4    220 DATA 18,167,98,53,180,18
      0,52,180,64,143,136,210,5,87
      ,223,84,1880
FA    230 DATA 36,47,170,18,23,213
      ,9,1,176,224,35,112,219,135,
      191,126,1735
C5    240 DATA 227,220,156,87,207,
      8,8,164,218,239,0,138,77,177
      ,128,69,2123
A2    250 DATA 38,212,80,8,164,218
      ,0,17,73,180,128,34,147,107,
      122,2,1530
FB    260 DATA 41,54,177,128,144,1
      64,219,130,4,7,139,198,232,2
      6,68,244,1975
BE    270 DATA 108,47,25,172,56,9,
      77,109,1,32,52,182,23,104,17
      0,221,1388
BF    280 DATA 137,24,20,127,9,197
      ,242,159,72,88,155,55,242,13
      4,110,36,1807
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72    290 DATA 250,66,111,193,241,
      195,22,189,132,34,88,74,157,
      133,227,53,2165
53    300 DATA 173,79,149,45,53,14
      8,252,161,99,100,106,133,192
      ,123,177,163,2153
D3    310 DATA 11,40,208,224,183,2
      03,209,227,42,183,191,126,24
      6,58,107,155,2413
71    320 DATA 43,80,9,221,122,134
      ,26,113,173,43,41,141,135,26
      ,67,25,1399
CB    330 DATA 6,116,226,188,163,5
      0,238,34,70,196,223,131,221,
      16,35,72,1985
58    340 DATA 68,214,214,182,150,
      134,140,7,149,75,110,221,64,
      117,99,118,2062
01    350 DATA 129,1,12,214,11,82,
      185,156,144,25,62,165,169,17
      1,201,245,1972
38    360 DATA 45,77,94,79,169,106
      ,106,242,125,75,83,87,1,20,4
      3,212,1564
B7    370 DATA 48,54,168,87,173,21
      0,25,172,117,99,118,129,2,4,
      4,51,1461
CB    380 DATA 56,170,12,149,148,1
      81,53,121,43,41,106,106,242,
      86,82,212,1808
BE    390 DATA 213,228,172,165,169
      ,171,131,107,154,189,107,29,
      88,221,160,33,2337
33    400 DATA 155,168,0,144,83,32
      ,189,177,254,215,73,52,247,2
      50,37,28,2104
38    410 DATA 8,190,212,188,12,24
      4,9,232,217,224,114,155,114,
      167,165,103,2354
73    420 DATA 152,63,24,224,50,23
      3,198,28,160,37,85,238,248,1
      54,230,252,2376
29    430 DATA 31,20,107,105,107,5
      4,177,165,140,193,248,198,2,
      116,94,165,1922
21    440 DATA 75,198,196,210,0,14
      6,23,177,206,52,177,119,88,1
      54,195,143,2159
0F    450 DATA 113,81,147,82,3,70,
      65,99,91,112,17,139,94,163,2
      24,16,1516
8F    460 DATA 104,145,45,87,165,8
      7,216,154,132,26,17,47,14,3,
      73,16,1331
56    470 DATA 35,198,85,125,245,7
      0,59,234,140,119,213,24,192,
      69,117,132,2057
28    480 DATA 150,57,184,135,138,
      12,166,222,160,153,191,56,21
      2,195,99,211,2341
3F    490 DATA 138,249,225,80,203,
      83,87,150,166,175,45,77,94,9
      0,154,188,2204
2B    500 DATA 181,53,121,106,106,
      224,56,219,203,174,145,162,2
      51,99,248,25,2373
9C    510 DATA 203,240,137,128,97,
      61,27,48,185,65,37,253,172,2
      7,46,182,1908
38    520 DATA 111,5,50,81,80,73,1
      20,218,190,21,40,53,165,40,5
      8,23,1328
93    530 DATA 98,65,183,133,96,12
      7,119,238,85,110,164,7,249,7
      2,225,97,2068
A0    540 DATA 176,142,169,134,30,
      199,101,21,177,172,130,220,1
      83,155,22,72,2103
7D    550 DATA 229,145,162,196,86,
      163,133,170,44,74,151,154,11
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    ,233,244,135,2330
A7  560 DATA 117,10,140,121,98,8
    8,30,241,43,219,193,43,219,1
    95,229,84,2070
F9  570 DATA 111,168,36,235,120,
    86,7,101,19,118,159,34,78,89
    ,115,99,1575
39  580 DATA 74,100,127,181,69,1
    54,62,37,196,52,177,82,153,1
    61,106,190,1921
64  590 DATA 151,110,181,28,78,2
    ,186,14,237,176,94,149,216,1
    47,173,228,2170
E0  600 DATA 249,18,102,203,203,
    26,83,35,253,180,140,39,125,
    108,37,42,1843
FD  610 DATA 218,74,211,23,197,3
    0,47,138,57,107,74,242,86,15
    2,190,40,1886
C5  620 DATA 241,124,81,203,90,8
    7,7,101,138,79,136,54,180,12
    3,240,0,1884
D2  630 DATA 23,214,41,57,15,95,
    163,172,114,226,249,94,74,21
    1,18,37,1803
5C  640 DATA 71,137,18,9,12,226,
    78,186,197,128,68,168,241,34
    ,84,114,1771
FD  650 DATA 214,128,236,199,164
    ,219,64,199,105,97,60,49,129
    ,217,143,73,2296
52  660 DATA 160,64,203,178,187,
    240,64,196,137,174,104,190,2
    13,252,12,184,2558
98  670 DATA 73,167,165,56,83,19
    5,38,109,251,243,17,56,190,4
    0,230,34,1947
77  680 DATA 113,124,81,203,155,
    93,149,156,103,111,196,168,7
    ,20,27,16,1722
C9  690 DATA 107,183,144,119,109
    ,140,3,232,93,170,99,248,196
    ,37,42,218,2140
44  700 DATA 52,149,166,47,139,2
    36,95,23,210,214,145,164,173
    ,49,124,95,2081
86  710 DATA 98,248,190,150,180,
    7,111,105,57,144,152,38,105,
    1,57,168,1811
DF  720 DATA 7,111,105,56,41,160
    ,17,229,245,143,23,200,210,8
    6,152,145,1930
24  730 DATA 43,236,72,144,72,16
    2,213,128,237,218,37,125,137
    ,18,190,150,2182
20  740 DATA 180,7,102,13,171,14
    1,72,13,219,43,189,74,14,204
    ,27,86,1555
F0  750 DATA 143,95,209,99,160,1
    72,84,88,145,42,19,69,240,17
    5,224,103,2067
AA  760 DATA 160,7,124,18,96,145
    ,26,76,222,253,230,34,113,12
    4,95,76,1799
FF  770 DATA 68,226,248,190,151,
    53,149,72,130,251,204,147,16
    3,241,12,205,2510
1E  780 DATA 192,51,2,147,1,26,1
    48,154,61,223,91,22,109,140,
    211,135,1713
86  790 DATA 196,184,179,4,105,1
    00,154,122,85,249,242,36,205
    ,230,166,12,2269
D2  800 DATA 105,73,17,126,216,1
    00,204,157,210,242,215,147,1
    86,94,90,242,2424
DB  810 DATA 119,75,203,94,78,23
    3,121,107,128,142,251,87,208
    ,27,93,246,2212
48  820 DATA 173,98,143,233,30,2
    00,27,183,219,123,37,0,212,1
    25,163,61,2027
88  830 DATA 239,224,102,160,169
    ,232,9,69,226,154,94,85,101,
    118,198,113,2293
AD  840 DATA 153,8,19,165,229,86
    ,87,108,103,25,34,2,55,201,5
    3,75,1403
6F  850 DATA 180,174,131,173,30,
    11,237,74,78,59,162,24,20,10
    2,22,109,1594
C1  860 DATA 38,52,4,68,181,118,
    88,208,95,82,181,106,248,18,
    75,32,1589
D2  870 DATA 3,241,5,224,53,122,
    86,144,46,64,80,154,143,132,
    103,141,1741
40  880 DATA 252,32,58,17,164,23
    8,151,150,52,157,210,242,198
    ,147,186,94,2348
AC  890 DATA 88,210,119,75,202,4
    ,51,202,140,32,218,207,42,87
    ,84,146,1844
A6  900 DATA 25,157,1,29,134,50,
    48,9,7,235,87,146,113,83,20
    ,47,1379
3C  910 DATA 175,17,49,165,229,2
    24,100,140,3,198,151,151,12
    ,153,96,78,2058
44  920 DATA 118,90,182,245,140,
    86,221,99,218,184,59,182,20
    ,90,0,233,2354
6C  930 DATA 5,179,35,137,164,1
    3,80,171,125,155,126,227,12
    ,82,184,9,1991
76  940 DATA 45,92,7,114,213,68,
    173,209,214,48,165,53,70,4,
    30,201,1912
25  950 DATA 55,121,5,190,60,64,
    211,70,233,55,246,37,27,164,
    210,152,1900
D6  960 DATA 157,139,47,186,77,
    7,234,214,208,9,251,203,16
    2,60,93,2129
3D  970 DATA 130,149,118,237,84,
    166,144,4,134,203,181,202,4
    ,252,69,69,2187
80  980 DATA 56,144,105,185,200,
    83,194,166,206,51,96,34,101,
    109,15,245,1990
FC  990 DATA 86,131,35,14,38,19
    ,81,147,50,240,52,186,195,6
    ,135,84,1752
92  1000 DATA 87,186,16,8,197,9
    ,243,21,203,177,49,74,131,1
    5,212,204,2053
C0  1010 DATA 150,28,213,80,156,
    133,216,152,165,68,200,101,
    48,53,148,10,2021
6D  1020 DATA 41,200,120,198,10
    ,112,89,213,70,72,171,196,9
    ,173,140,94,2091
FD  1030 DATA 54,106,189,252,12
    181,46,90,76,108,225,229,21
    ,23,198,242,2244
96  1040 DATA 241,164,198,202,3
    ,29,81,124,37,132,223,43,18
    ,12,206,42,1953
F2  1050 DATA 41,177,181,42,177
    97,254,190,159,22,36,4,105,
    2,133,137,1817
4E  1060 DATA 1,26,91,15,26,91,
    4,138,108,109,49,104,33,98,
    4,73,1040
3B  1070 DATA 79,11,18,2,188,18
    ,209,165,230,80,153,246,42,
    22,196,213,2142
6D  1080 DATA 40,211,216,98,251
    66,11,242,248,76,151,241,5,
    91,52,104,2203
29  1090 DATA 59,182,138,8,8,20
    ,0,0,0,0,0,0,0,0,0,0,598
```

MOVING EXPERIENCE

PROGRAM: SPRITE

```
F1  0 REM AS YOU READ THE ARTICL
    E REMOVE THE        REMS ONE B
    Y ONE IN THIS ORDER:
0A  1 REM 80,90,100,110,120,130,
    140,150
C1  2 REM ***************************
    ****
19  10 DATA0,0,0
37  20 DATA0,255,0,0,127,252,0,10
    6,252,0,42,171,192,42,171,24
    0,27
55  30 DATA234,188,31,250,175,31
    ,250,175,27,234,170
1C  40 DATA26,170,169,22,154,104
    ,21,90,144,21,105,64,149,104
    ,0,85
AF  50 DATA84,0,85,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,0,0,0
64  60 FORA=832 TO 896:READB:POK
    EA,B:NEXT:POKE53269,0
E5  70 POKE53280,8:POKE53281,9
C3  80 REM POKE2041,13
BA  90 REM POKE53288,6
A7  100 REM POKE53269,PEEK(53269
    )OR(2^1)
5A  110 REM POKE53250,100:POKE53
    251,100
EB  120 REM POKE53276,PEEK(53276
    )OR(2^1)
2A  130 REM POKE53285,0:POKE5328
    6,14
CF  140 REM GOSUB170
AB  150 REM GOSUB270
20  160 END
41  170 PRINT"[CLR]":FORA=0TO255
    :POKE53250,A:NEXT
2D  180 PRINT"[DOWN]BLOCKING 53
    250 HAS REACHED 255"
A7  190 PRINT"[DOWN]NOW IF THE N
    INTH BYTE IS SWITCHED ON"
F1  200 PRINT"USING POKE53264,PE
    EK(53264)OR(2^1)":FORA=1TO30
    00:NEXT
12  210 POKE53264,PEEK(53264)OR(
    2^1):PRINT"[DOWN]THE SPRITE
    DISAPPEARS"
09  220 FORA=0TO3000:NEXT:PRINT"
    [DOWN]BUT POKE 53250,0 BRING
    S IT BACK"
E7  230 FORA=0TO3000:NEXT:POKE 5
    3250,0
20  240 PRINT"AND IT CAN CONTINU
    E ACROSS THE SCREEN"
6F  250 FORA=1TO90:POKE53250,A:N
    EXT
88  260 RETURN
87  270 FORA=0TO1000:POKE53264,0
    :POKE53250,0:FORA=0TO255:POK
    E53250,A:NEXT
7E  280 POKE53264,0:POKE53264,2:
    FORA=1TO90:POKE53250,A:NEXTA
    B
A0  290 RETURN
```

80-COL VIDEO

```
10 REM *********************************
20 REM ****** PROGRAM TO RETRIEVE ******
30 REM **** CHAR-SET FILE FROM DISC ****
40 REM ** AND REPLACE IN 80-COL SCREEN *
50 REM ****** (C) D.ANDERSON 1986 ******
60 REM *********************************
70 DATA A2,1F,8E,00,D6,2C,00,D6,807
80 DATA 10,FB,AD,01,D6,60,A9,3E,982
90 DATA 8D,00,FF,A9,00,A0,B0,85,1034
100 DATA DA,84,DB,A2,12,A9,20,20,982
110 DATA 3D,A0,E8,A9,00,20,3D,A0,875
120 DATA A0,00,20,00,A0,91,DA,C8,915
130 DATA D0,F8,E6,DB,A5,DB,C9,D0,1698
140 DATA D0,F0,60,A2,1F,8E,00,D6,1093
150 DATA 2C,00,D6,10,FB,8D,01,D6,881
160 DATA 60,A9,3E,8D,00,FF,A9,00,892
170 DATA A0,B0,85,DA,84,JB,A2,12,1218
180 DATA A9,20,20,3D,A0,E8,A9,00,855
190 DATA 20,3D,A0,A0,00,B1,DA,20,840
200 DATA 38,A0,C8,D0,F8,E6,DB,A5,1489
210 DATA DB,C9,D0,D0,F0,60,60,60,1364
220 FOR A=0 TO 14
230 :  FOR B=0 TO 7
240 :    READ MC$
250 :    POKE DEC("A000")+(A*8)+B,DEC(MC$)
260 :    CS=CS+DEC(MC$)
270 :  NEXT B
280 :  READ CI:IF CI<>CS THEN PRINT "DATA ERROR":END
290 :  CS=0
300 NEXT A
320 BLOAD "CHAR-SET"
330 BANK 0:SYS DEC("A049"):REM TRANSFER CONTENTS OF $8000-$D000
     INTO 80-COL CHAR RAM
```

```
4 REM *****   (C) D.ANDERSON 1986   *****
10 FAST:GOSUB 2000:BANK 0:SYS DEC("A00E")
20 ALT=128:PRINTCHR$(14);
30 H$="▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚"
40 V$="▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚▚"
50 X=1:Y=1
60 PRINT"▚▚USE CURSOR KEYS, ←=STORE CHARACTER, ESC=SAVE AND QUIT,
   1=SET, 2=CLEAR PIXEL     "
65 PRINT"▚X=FLIP ABOUT X-AXIS, Y=FLIP ABOUT Y-AXIS,
  R=REVERSE CHARACTER

70 PRINT
80 PRINTLEFT$(V$,11);"▚▚LOWER CASE SET"
90 PRINT"▚▚▚▚▚UPPER CASE/GRAPHICS SET▚▚▚"
100 GOSUB 990
110 PRINT "▚▚ 12345678 ■"
120 PRINT"▚1■          ▚1■"
130 PRINT"▚2■          ▚2■"
140 PRINT"▚3■          ▚3■"
150 PRINT"▚4■          ▚4■"
160 PRINT"▚5■          ▚5■"
170 PRINT"▚6■          ▚6■"
180 PRINT"▚7■          ▚7■"
190 PRINT"▚8■          ▚8■"
200 PRINT"▚ 12345678 ■"
220 GOSUB 470
225 DO
230 :  GETKEY A$
240 :  IF (A$="▚" AND X<8) OR (A$="▚" AND X>1) OR (A$="▚" AND Y<8)
OR (A$="▚" AND Y>1) OR A$="▚" OR A$="▚" THEN BEGIN
250 :     PRINT "▚▚▚"+LEFT$(H$,X)+LEFT$(V$,Y);
260 :     IF CH(X,Y)=0 THEN PRINT "▚ ";:ELSE PRINT "▚▚ ■";
270 :  BEND
280 :  IF A$="▚" AND X<8 THEN X=X+1:GOSUB 470
281 :  IF A$="X" THEN GOSUB 1090
282 :  IF A$="Y" THEN GOSUB 1170
283 :  IF A$="R" THEN GOSUB 1260
290 :  IF A$="▚" AND X>1 THEN X=X-1:GOSUB 470
300 :  IF A$="▚" AND Y<8 THEN Y=Y+1:GOSUB 470
```

```
310 :   IF A$="⊐" AND Y>1 THEN Y=Y-1:GOSUB 470
330 :   IF A$="←" THEN GOSUB 600
340 :   IF A$="1" THEN CH(X,Y)=1:PRINT"▮▮▮▮"+LEFT$(H$,X)+
        LEFT$(V$,Y);"▮▮+▮";
350 :   IF A$="2" THEN CH(X,Y)=0:PRINT"▮▮▮▮"+LEFT$(H$,X)+
        LEFT$(V$,Y);"▮+";
360 :   IF A$="▚" THEN X=1:Y=1:GOSUB 470
370 :   IF A$="⊐" THEN BEGIN
380 :     FOR Y=1 TO 8
390 :       FOR X=1 TO 8
400 :         CH(X,Y)=0
410 :       NEXT X
420 :     NEXT Y
430 :     X=1:Y=1:GOSUB 500
440 :   BEND
450 LOOP UNTIL A$=CHR$(27)
455 BSAVE "CHAR-SET",B0,P45056 TO P53248:PRINT"⊐|YE...":END
460 REM MOVE CURSOR
470 :   PRINT "▮▮▮▮"+LEFT$(H$,X)+LEFT$(V$,Y);
480 :   IF CH(X,Y)=0 THEN PRINT "▮+";:ELSE PRINT "▮▮+▮";
490 RETURN
500 REM PRINT OUT CHAR ONTO GRID
510 :   PRINT"▮▮▮▮▮▮";
520 :   FOR Y=1 TO 8
530 :     FOR X=1 TO 8
540 :       IF CH(X,Y)=1 THEN PRINT"▮▮ ▮";:ELSE PRINT"▮ ";
550 :     NEXT X
560 :     PRINTCHR$(13);"▮";
570 :   NEXT Y
580 :   X=1:Y=1:GOSUB 470
590 RETURN
600 REM STORE INTO CHAR RAM
610 :   WINDOW 15,3,79,10
620 :   PRINT"UPPER CASE/GRAPHICS, OR LOWER CASE CHARACTER SET?"
630 :   PRINT"(U/L)  >"
635 :   DO
640 :     GETKEY A$
650 :   LOOP UNTIL (A$="U" OR A$="L")
660 :   IF A$="U" THEN ALT=0:ELSE ALT=128
670 :   PRINT "USE LEFT & RIGHT ARROW KEYS TO SELECT CHAR"
680 :   PRINT
690 :   POKE DEC("A07F"),INT(580/256):POKE DEC("A085"),
        (580 AND 255):POKE DEC("A0 8A"),CN:SYS DEC("A077")
        :REM POKE CHAR INTO 80-COL SCREEN
700 :   POKE DEC("A07F"),INT((580+DEC("800"))/256):POKE DEC("A085"),
        ((580+DEC("800")) AND 255):POKE DEC("A08A"),15+ALT:
        SYS DEC("A077"):PRINT CN:REM & COLOUR
710 :   DO
720 :     GETKEY A$
730 :     IF A$="▮" AND CN<255 THEN CN=CN+1
740 :     IF A$="▮" AND CN>0 THEN CN=CN-1
750 :     POKE DEC("A07F"),INT(580/256):POKE DEC("A085"),
          (580 AND 255):POKE DEC("A08A"),CN:SYS DEC("A077"):
          REM POKE CHAR INTO 80-COL SCREEN
760 :     POKE DEC("A07F"),INT((580+DEC("800"))/256):
          POKE DEC("A085"),((580+DEC("800")) AND 255):
          POKE DEC("A08A"),15+ALT:SYS DEC("A077"):PRINT "";CN
770 :   LOOP UNTIL A$=CHR$(13)
780 :   GOSUB 810
790 :   PRINT"⊐▮▮";:GOSUB 500
800 RETURN
810 REM STORE
820 :   NO=0
830 :   FOR Y=1 TO 8
840 :     FOR X=1 TO 8
850 :       IF CH(X,Y)=1 THEN NO=NO+2↑(7-(X-1))
860 :     NEXT X
870 :     IF ALT=128 THEN BEGIN
880 :       PO=DEC("3000")+CN*16+(Y-1)
890 :       POKE DEC("A07F"),INT(PO/256):POKE DEC("A085"),
      (PO AND 255):POKE DEC(" A08A"),NO:SYS DEC("A077"):NO=0
900 :       POKE DEC("C000")+CN*16+(Y-1),NO:NO=0
910 :     BEND
920 :     IF ALT=0 THEN BEGIN
930 :       PO=DEC("2000")+CN*16+(Y-1)
940 :       POKE DEC("A07F"),INT(PO/256):POKE DEC("A085"),
            (PO AND 255):POKE DEC(" A08A"),NO:SYS DEC("A077"):NO=0
950 :       POKE DEC("B000")+CN*16+(Y-1),NO:NO=0
960 :     BEND
970 :   NEXT Y
```

ADVENTURE KIT

PROGRAM: WINDOW.BAS

```
AF   10 REM******************
92   20 REM* ADVENTURE KIT 5 *
1F   30 REM* WINDOW HANDLER  *
05   40 REM******************
B0   2000 FORL=0TO37:CX=0:FORD=0T
     015:READA:CX=CX+A:POKE49920+
     L*16+D,A:NEXTD
82   2010 READA:IFA<>CXTHENPRINT"
     ERROR IN LINE";2040+(L*10):S
     TOP
0F   2020 NEXTL:END
DA   2040 DATA76,96,195,0,0,0,0,0
     ,0,0,0,0,0,0,0,251,618
99   2050 DATA72,74,110,74,64,251
     ,64,74,68,110,64,123,89,74,7
     8,239,1628
FB   2060 DATA64,75,233,74,67,238
     ,64,75,233,218,64,238,64,74,
     105,218,2104
31   2070 DATA64,238,64,106,105,2
     23,107,0,75,239,249,222,75,2
     38,69,95,2169
E7   2080 DATA15,138,0,63,0,10,36
     ,10,0,174,0,10,36,10,0,175,6
     77
B9   2090 DATA0,10,169,26,0,190,3
     6,10,59,155,0,62,38,10,15,15
     5,935
FA   2100 DATA32,77,197,141,9,195
     ,32,77,197,141,5,195,32,77,1
     97,141,1745
82   2110 DATA6,195,32,77,197,141
     ,7,195,32,77,197,141,8,195,1
     73,9,1682
EF   2120 DATA195,201,1,208,3,76,
     67,196,201,2,208,3,76,195,19
     6,201,2029
ED   2130 DATA3,240,30,201,5,240,
     15,32,77,197,141,10,195,32,7
     7,197,1692
C7   2140 DATA141,12,195,76,177,1
     95,169,32,141,10,195,173,134
     ,2,141,12,1805
D8   2150 DATA195,173,5,195,141,3
     ,195,173,6,195,141,4,195,32,
     11,196,1860
55   2160 DATA169,0,141,11,195,16
     0,0,173,9,195,201,3,240,13,1
     73,10,1693
F8   2170 DATA195,145,251,173,12,
     195,145,253,76,225,195,177,2
     51,73,128,145,2639
71   2180 DATA251,200,204,7,195,2
     08,224,32,246,195,238,11,195
     ,173,11,195,2585
D6   2190 DATA205,8,195,208,208,9
     6,24,165,251,105,40,133,251,
     133,253,165,2440
B5   2200 DATA252,105,0,133,252,2
     4,105,212,133,254,96,169,0,1
     33,251,169,2288
9B   2210 DATA4,133,252,173,4,195
     ,240,21,24,165,251,105,40,13
     3,251,165,2156
7B   2220 DATA252,105,0,133,252,2
     06,4,195,173,4,195,208,235,2
     4,165,251,2402
4F   2230 DATA109,3,195,133,251,1
     33,253,165,252,105,0,133,252
     ,24,105,212,2325
```

ADVENTURE KIT (Cont.)

```
83   2240 DATA133,254,96,169,0,14
     1,11,195,206,8,195,238,6,195
     ,173,6,2026
B5   2250 DATA195,141,4,195,173,5
     ,195,141,3,195,32,11,196,160
     ,0,177,1823
F0   2260 DATA251,153,14,195,177,
     253,153,55,195,200,204,7,195
     ,208,240,206,2706
B5   2270 DATA6,195,173,6,195,141
     ,4,195,173,5,195,141,3,195,3
     2,11,1670
90   2280 DATA196,160,0,185,14,19
     5,145,251,185,55,195,145,253
     ,200,204,7,2390
6A   2290 DATA195,208,240,238,11,
     195,173,11,195,205,8,195,240
     ,6,238,6,2364
D9   2300 DATA195,76,75,196,238,6
     ,195,173,6,195,141,4,195,173
     ,5,195,2068
3E   2310 DATA141,3,195,32,11,196
     ,160,0,169,32,145,251,200,20
     4,7,195,1941
DD   2320 DATA208,248,96,169,0,14
     1,11,195,206,8,195,24,173,6,
     195,109,1984
BD   2330 DATA8,195,141,6,195,206
     ,6,195,173,6,195,141,4,195,1
     73,5,1844
7B   2340 DATA195,141,3,195,32,11
     ,196,160,0,177,251,153,14,19
     5,177,253,2153
B4   2350 DATA153,55,195,200,204,
     7,195,208,240,238,6,195,173,
     6,195,141,2411
A8   2360 DATA4,195,173,5,195,141
     ,3,195,32,11,196,160,0,185,1
     4,195,1704
51   2370 DATA145,251,185,55,195,
     145,253,200,204,7,195,208,24
     0,238,11,195,2727
09   2380 DATA173,11,195,205,8,19
     5,240,6,206,6,195,76,213,196
     ,206,6,2137
79   2390 DATA195,173,6,195,141,4
     ,195,173,5,195,141,3,195,32,
     11,196,1860
```

80-COL VIDEO (Cont.)

```
980 RETURN
990 REM PRINT CHAR SETS
1000 :  FOR A=0 TO 255
1010 :    POKE DEC("A07F"),INT((1200+A)/256):POKE DEC("A085"),
          ((1200+A) AND 255):POKE DEC("A08A"),A:SYS DEC("A077")
1020 :    POKE DEC("A07F"),INT((3248+A)/256):POKE DEC("A085"),
        ((3248+A) AND 255):POKE DEC("A08A"),15+128:SYS DEC("A077")
1030 :  NEXT
1040 :  FOR A=0 TO 255
1050 :    POKE DEC("A07F"),INT((1680+A)/256):POKE DEC("A085"),
          ((1680+A) AND 255):POKE DEC("A08A"),A:SYS DEC("A077")
1060 :    POKE DEC("A07F"),INT((3728+A)/256):POKE DEC("A085"),
          ((3728+A) AND 255):POKE DEC("A08A"),15:SYS DEC("A077")
1070 :  NEXT
1080 RETURN
1090 REM  X-FLIP
1100 :  FOR Y=1 TO 4
1110 :    FOR X=1 TO 8
1120 :      A=CH(X,Y)
1130 :      CH(X,Y)=CH(X,9-Y):CH(X,9-Y)=A
1140 :    NEXT X
1150 :  NEXT Y
1155 :  GOSUB 500
1160 RETURN
1170 REM Y-FLIP
1180 :  FOR X=1 TO 4
1190 :    FOR Y=1 TO 8
1200 :      A=CH(X,Y)
1210 :      CH(X,Y)=CH(9-X,Y):CH(9-X,Y)=A
1220 :    NEXT Y
1230 :  NEXT X
1240 :  GOSUB 500
1250 RETURN
1260 REM REVERSE
1270 :  FOR X=1 TO 8
1280 :    FOR Y=1 TO 8
1290 :      IF CH(X,Y)=1 THEN CH(X,Y)=0:ELSE CH(X,Y)=1
1300 :    NEXT Y
1310 :  NEXT X
1320 :  GOSUB 500
1330 RETURN
2000 REM ******* MACHINE CODE ***********
2010 DATA A2,1F,8E,00,D6,2C,00,D6,807
2020 DATA 10,FB,AD,01,D6,60,A9,3E,982
2030 DATA 8D,00,FF,A9,00,A0,B0,85,1034
2040 DATA DA,84,DB,A2,12,A9,20,20,982
2050 DATA 3D,A0,E8,A9,00,20,3D,A0,875
2060 DATA A0,00,20,00,A0,91,DA,C8,915
2070 DATA D0,F8,E6,DB,A5,DB,C9,D0,1698
2080 DATA D0,F0,60,A2,1F,8E,00,D6,1093
2090 DATA 2C,00,D6,10,FB,8D,01,D6,881
2100 DATA 60,A9,3E,8D,00,FF,A9,00,892
2110 DATA A0,B0,85,DA,84,DB,A2,12,1218
2120 DATA A9,20,20,3D,A0,E8,A9,00,855
2130 DATA 20,3D,A0,A0,00,B1,DA,20,840
2140 DATA 3B,A0,C8,D0,F8,E6,DB,A5,1489
2150 DATA DB,C9,D0,D0,F0,60,60,A9,1437
2160 DATA 3E,8D,00,FF,A2,12,A9,00,807
2170 DATA 20,3D,A0,E8,A9,00,20,3D,747
2180 DATA A0,A9,00,20,3B,A0,A2,12,760
2190 DATA 20,3D,A0,60,60,60,60,60,733
2200 FOR A=0 TO 18
2210 :  FOR B=0 TO 7
2220 :    READ MC$
2230 :    POKE DEC("A000")+(A*8)+B,DEC(MC$)
2240 :    CS=CS+DEC(MC$)
2250 :  NEXT B
2260 :  READ CT:IF CT<>CS THEN PRINT "DATA ERROR":END
2270 :  CS=0
2280 NEXT A
2290 RETURN
```

BYTING INTO 6510

```
ROUTINE TO BE INSERTED INTO MAIN ROUTINE
        780   ;SEE, IF BEG. OF NEXT LINE
        800             STA TEMPSTORE
        820             LDA #<1064
        830             STA <LINESTART
        840             LDA #>1064
        850             STA >LINESTART
        870             LDX #24
        880   COMPARE   LDA <SCREENMEM
        890             CMP <LINESTART
        900             BNE COMPARE1
        910             LDA >SCREENMEM
        920             CMP >LINESTART
        930             BNE COMPARE1
        950   ;IF YES, CALL WORDWRAP ROUTINE
        960   ;
        970             JSR WORDWRAP
        980             JMP CONTINUE
        990   ;
        1000  COMPARE1  CLC
        1010            LDA <LINESTART
        1020            ADC #40
        1030            STA <LINESTART
        1040            BCC COMPARE2
        1050            INC >LINESTART
        1070  COMPARE2  DEX
        1080            BNE COMPARE
        1090  ;
        1100  ;OTHERWISE RECOVER LETTER AND
        1110  ;CONTINUE AS NORMAL
        1120  ;
        1130  CONTINUE  LDA TEMPSTORE

        PRG-NAME: BYT'TYPEWRITER
        FILENAME: WORDWRAP ROUT.

        10              ORG 50100
        20    ;
        30    TEXTSAVE  EQU #A6
        40    SCRNSAVE  EQU 73
        50    COLRSAVE  EQU 75
        60    ;
        70    ;IF CURRENT LETTER IS A SPACE,
        80    ;WAIT FOR NEXT KEYPRESS AND EXIT
        100             LDA TEMPSTORE
        110             CMP #32
        120             BNE START
        140   GETKEY    JSR GETIN
        150             BEQ GETKEY
        170             STA TEMPSTORE
        190             RTS
        230   ;SAVE CURRENT TEXTFILE, SCREEN
        240   ;AND COLOUR SCREEN POSITIONS
        260   START     LDA <TEXTFILE
        270             STA <TEXTSAVE
        280             LDA >TEXTFILE
        290             STA >TEXTSAVE
        310             LDA <SCREENMEM
        320             STA <SCRNSAVE
        330             LDA >SCREENMEM
        340             STA >SCRNSAVE
        360             LDA <SCREENCOL
        370             STA <COLRSAVE
        380             LDA >SCREENCOL
        390             STA >COLRSAVE
        410   ;GO BACK IN TEXTFILE UNTIL SPACE
        420   ;IS FOUND
        440             LDX #0
        450             LDY #0
        460   GOBACK    LDA <TEXTSAVE
        470             BNE NOHIGH
        480             DEC >TEXTSAVE
        490   NOHIGH    DEC <TEXTSAVE
```

ADVENTURE KIT (CONT.)

```
D4  2400 DATA160,0,169,32,145,25
    1,200,204,7,195,208,248,96,3
    2,253,174,2374
2D  2410 DATA32,138,173,32,247,1
    83,165,20,164,21,96,15,98,98
    ,98,98,1678
```

PROGRAM: IRQ.BAS

```
AF  10 REM*******************
92  20 REM* ADVENTURE KIT 5 *
1B  30 REM* EVENT DRIVER    *
05  40 REM*******************
3F  2000 FORL=0TO13:CX=0:FORD=0T
    O15:READA:CX=CX+A:POKE50688+
    L*16+D,A:NEXTD
82  2010 READA:IFA<>CXTHENPRINT"
    ERROR IN LINE";2040+(L*10):S
    TOP
0F  2020 NEXTL:END
22  2040 DATA76,29,198,76,67,198
    ,76,173,198,76,198,198,0,143
    ,143,143,1992
BA  2050 DATA143,154,154,165,165
    ,198,198,198,198,198,198,198
    ,198,120,169,80,2734
57  2060 DATA141,20,3,169,198,14
    1,21,3,88,169,0,141,12,198,1
    60,0,1464
48  2070 DATA169,0,153,0,199,153
    ,8,199,169,1,153,16,199,200,
    192,8,1819
E3  2080 DATA208,238,96,120,169,
    49,141,20,3,169,234,141,21,3
    ,88,96,1796
B0  2090 DATA238,12,198,173,12,1
    98,201,60,208,50,169,0,141,1
    2,198,162,2032
1B  2100 DATA0,254,0,199,232,224
    ,8,208,248,162,0,189,8,199,2
    40,23,2194
DD  2110 DATA189,16,199,221,0,19
    9,208,15,189,21,198,141,63,3
    ,189,13,1864
0B  2120 DATA198,141,62,3,108,62
    ,3,232,224,8,208,223,76,49,2
    34,254,2085
60  2130 DATA24,199,169,0,157,0,
    199,76,135,198,222,24,199,16
    9,0,157,1928
4D  2140 DATA0,199,76,135,198,16
    9,0,157,24,199,76,135,198,32
    ,208,198,2004
62  2150 DATA72,32,208,198,170,1
    04,168,138,153,16,199,169,0,
    153,0,199,1979
99  2160 DATA169,1,153,8,199,96,
    32,208,198,168,169,0,153,8,1
    99,96,1857
31  2170 DATA32,253,174,32,138,1
    73,32,247,183,165,20,96,251,
    73,128,145,2142
```

BYTING INTO 6510 (CONT.)

```
500   ;
510             LDA <SCRNSAVE
520             BNE NOHIGH1
530             DEC >SCRNSAVE
540   NOHIGH1   DEC <SCRNSAVE
550   ;
560             LDA <COLRSAVE
570             BNE NOHIGH2
580             DEC >COLRSAVE
590   NOHIGH2   DEC <COLRSAVE
600   ;
610             LDA (TEXTSAVE),Y
620             CMP #32
630             BEQ SPACEFOUN
650             INX
660             BNE GOBACK
670   ;
680   ;GO FORWARD TO BEG. OF WORD
690   ;
700   SPACEFOUN INC <TEXTSAVE
710             BNE NOHIGH3
720             INC >TEXTSAVE
730   ;
740   NOHIGH3   INC <SCRNSAVE
750             BNE NOHIGH4
760             INC >SCRNSAVE
770   ;
780   NOHIGH4   INC <COLRSAVE
790             BNE MOVELOOP
800             INC >COLRSAVE
810   ;
820   ;MOVE LETTERS TO NEW POSITION AND
830   ;PAD END OF OLD LINE WITH SPACES
840   ;
850   MOVELOOP  LDA (TEXTSAVE),Y
860             STA (TEXTFILE),Y
870   ;
880             LDA (SCRNSAVE),Y
890             STA (SCREENMEM),Y
900             LDA #6
910             STA (SCREENCOL),Y
920   ;
930             LDA #32
940             STA (TEXTSAVE),Y
950             STA (SCRNSAVE),Y
960             LDA #6
970             STA (COLRSAVE),Y
980   ;
990             INY
1000  ;
1010            DEX
1020            BNE MOVELOOP
1030  ;
1040  ;UPDATE TEXTFILE, SCREEN AND
1050  ;COLOUR SCREEN POSITIONS
1060  ;
1070            TYA
1080            CLC
1090            ADC <TEXTFILE
1100            STA <TEXTFILE
1110            BCC NOHIGH5
1120            INC >TEXTFILE
1130  ;
1140  NOHIGH5   TYA
1150            CLC
1160            ADC <SCREENMEM
1170            STA <SCREENMEM
1180            BCC NOHIGH6
1190            INC >SCREENMEM
1200  ;
1210  NOHIGH6   TYA
1220            CLC
1230            ADC <SCREENCOL
1240            STA <SCREENCOL
1250            BCC EXIT
1260            INC >SCREENCOL
1270  ;
1280  ;EXIT BACK TO MAIN ROUTINE
1290  ;
1300  EXIT      RTS
```

MAY I INTERRUPT

```
85  10 REM
91  20 POKE53280,0:POKE53281,0:P
    RINT"[CLR,YELLOW,DOWN]LOADIN
    G PLEASE WAIT ........
E0  30 PRINT"[DOWN3]AFTER RUNNIN
    G THE SCREEN WILL DISPLAY"
71  40 PRINT"[DOWN]RUBBISH AND T
    HEN THE DEMO WILL START."
0D  50 BL=579:LN=100:SA=40960
07  60 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A
B4  70 POKE 53280,A:NEXTD
BB  80 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
B4  90 NEXT L
99  100 DATA 162,0,189,67,8,157,
    0,1,232,224,161,208,245,162,
    13,189,2018
A2  110 DATA 222,8,149,234,202,1
    6,248,120,165,1,133,237,160,
    0,132,1,2028
29  120 DATA 76,0,1,177,244,145,
    238,230,238,208,2,230,239,23
    0,244,208,2710
80  130 DATA 2,230,245,165,239,1
    97,243,144,234,208,6,165,238
    ,197,242,144,2899
55  140 DATA 226,177,242,145,240
    ,198,240,165,240,201,255,208
    ,2,198,241,198,3176
24  150 DATA 242,165,242,201,255
    ,208,2,198,243,165,243,201,8
    ,176,226,165,2940
57  160 DATA 240,24,105,2,133,24
    0,208,2,230,237,160,0,177,24
    0,197,236,2431
EA  170 DATA 240,39,238,0,4,145,
    234,230,234,208,2,230,235,23
    0,240,208,2717
33  180 DATA 2,230,241,165,241,1
    97,247,144,225,208,6,165,240
    ,197,246,144,2898
CA  190 DATA 217,165,237,133,1,8
    8,76,32,8,160,2,177,240,170,
    136,177,2019
36  200 DATA 240,136,145,234,72,
    230,234,208,2,230,235,104,20
    2,208,243,165,2888
9A  210 DATA 240,24,105,3,133,24
    0,144,178,230,241,169,0,240,
    172,1,8,2128
08  220 DATA 54,0,1,8,98,104,71,
    43,236,8,98,104,22,8,195,7,1
    057
DD  230 DATA 158,50,48,56,48,58,
    143,34,54,20,4,82,65,84,84,5
    4,1042
7A  240 DATA 0,11,162,0,189,115,
    8,157,0,1,232,224,147,208,24
    5,162,1861
D9  250 DATA 0,189,10,9,157,0,2,
    232,224,84,208,245,169,62,13
    3,252,1976
0F  260 DATA 169,3,133,253,173,6
    ,9,133,250,173,7,9,133,251,1
    73,8,1883
6B  270 DATA 9,133,248,173,9,9,1
    33,249,165,248,56,229,250,13
    3,254,165,2463
D3  280 DATA 249,229,251,133,255
    ,165,254,24,105,61,133,254,1
    65,255,105,3,2641
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37  290 DATA 133,255,76,0,1,120,
    165,1,133,247,169,0,133,1,16
    0,0,1594
F8  300 DATA 177,250,145,252,230
    ,250,208,2,230,251,230,252,2
    08,2,230,253,3170
69  310 DATA 165,251,197,249,144
    ,234,208,6,165,250,197,248,1
    44,226,162,4,2850
D7  320 DATA 189,0,2,24,125,2,2,
    133,250,189,1,2,125,3,2,133,
    1182
40  330 DATA 251,165,250,56,233,
    1,133,250,165,251,233,0,133,
    251,189,2,2563
03  340 DATA 2,133,252,189,3,2,1
    33,253,160,0,177,254,145,250
    ,165,254,2372
A1  350 DATA 56,233,1,133,254,16
    5,255,233,0,133,255,165,250,
    56,233,1,2423
06  360 DATA 133,250,165,251,233
    ,0,133,251,165,252,56,233,1,
    133,252,165,2673
FF  370 DATA 253,233,0,133,253,5
    ,252,208,209,138,56,233,4,17
    0,16,160,2323
5F  380 DATA 165,247,133,1,88,76
    ,0,96,20,9,98,104,1,8,217,89
    ,1352
30  390 DATA 0,192,117,5,0,0,54,
    32,255,54,32,30,62,57,65,56,
    1011
27  400 DATA 54,57,4,65,56,54,57
    ,4,65,56,57,58,54,32,90,62,8
    25
73  410 DATA 57,65,56,54,57,4,65
    ,56,57,58,54,32,17,142,143,5
    4,971
EB  420 DATA 32,16,142,143,54,32
    ,34,39,2,2,3,1,2,2,89,54,647

9D  430 DATA 32,55,63,64,61,53,5
    2,54,61,4,53,52,54,61,4,53,7
    76
AF  440 DATA 52,61,59,60,54,32,4
    4,20,21,22,23,24,25,20,21,22
    ,560
25  450 DATA 23,24,25,54,32,32,6
    3,64,61,53,52,54,61,4,53,52,
    707
E9  460 DATA 61,59,60,54,32,16,1
    40,141,54,32,16,140,141,54,3
    2,34,1066
AD  470 DATA 40,41,7,8,6,7,88,19
    ,54,32,31,142,143,54,32,21,7
    25
92  480 DATA 63,64,61,61,53,52,5
    4,61,4,53,52,54,61,4,53,52,8
    02
2D  490 DATA 61,61,59,60,54,32,9
    ,142,143,54,32,10,142,143,54
    ,32,1088
BC  500 DATA 21,16,17,18,19,32,3
    2,16,17,18,19,54,32,32,63,64
    ,470
5B  510 DATA 61,61,53,52,54,61,4
    ,53,52,61,61,59,60,54,32,15,
    793
10  520 DATA 102,103,54,32,16,10
    2,103,54,32,34,42,43,44,54,3
    2,3,850
8C  530 DATA 42,43,44,54,32,30,1
    40,141,54,32,20,63,64,54,61,
    3,877
DD  540 DATA 53,52,54,61,4,53,52
    ,54,61,4,53,52,54,61,3,59,73
    0
1E  550 DATA 60,54,32,8,140,141,
    54,32,10,140,141,54,32,4,39,
    2,943
BA  560 DATA 2,3,1,54,2,4,3,1,54
    ,2,4,3,1,12,13,14,173
47  570 DATA 15,3,1,12,13,14,15,
    3,1,2,2,89,54,32,26,63,345
9E  580 DATA 64,54,61,3,53,52,54
    ,61,4,53,52,54,61,3,59,60,74
    8
02  590 DATA 54,32,14,100,101,54
    ,32,16,100,101,54,32,16,142,
    143,54,1045
54  600 DATA 32,4,39,2,2,3,1,54,
    2,4,3,1,2,45,19,54,267
78  610 DATA 32,4,40,19,54,32,31
    ,102,103,32,32,20,21,22,23,2
    4,591
9B  620 DATA 25,54,32,12,52,54,6
    1,4,53,52,54,61,4,53,52,54,6
    77
9E  630 DATA 61,4,53,52,54,61,4,
    53,54,32,8,102,103,54,32,10,
    737
18  640 DATA 102,103,54,32,4,40,
    41,7,8,6,54,7,4,8,6,54,530
36  650 DATA 7,4,8,6,54,7,4,8,6,
    54,7,4,8,6,7,88,278
21  660 DATA 19,32,32,20,21,22,2
    3,24,25,20,21,22,23,24,25,54
    ,407
1F  670 DATA 32,12,52,54,61,4,53
    ,52,54,61,4,53,52,54,61,4,66
    3
5C  680 DATA 53,54,32,14,100,101
    ,54,32,16,100,101,54,32,16,1
    40,141,1040
46  690 DATA 54,32,4,40,41,7,8,6
    ,54,7,4,8,6,7,7,46,331
9A  700 DATA 54,32,4,40,19,54,32
    ,31,100,101,54,32,3,16,17,18
    ,607
56  710 DATA 19,54,32,13,82,54,5
    0,4,83,82,54,50,4,83,82,54,8
    00
8F  720 DATA 50,4,83,82,54,50,4,
    83,54,32,8,100,101,54,32,10,
    801
E8  730 DATA 100,101,54,32,4,42,
    43,44,54,32,27,42,43,44,32,3
    2,726
0B  740 DATA 16,17,18,19,32,32,1
    6,17,18,19,54,32,10,62,57,65
    ,484
57  750 DATA 82,54,50,4,83,82,54
    ,50,4,83,82,54,50,4,83,56,87
    5
44  760 DATA 57,58,54,32,11,100,
    101,54,32,16,100,101,54,32,1
    6,102,920
61  770 DATA 103,54,32,4,42,43,4
    4,54,32,15,42,43,44,54,32,30
    ,668
4E  780 DATA 100,101,32,32,33,34
    ,35,36,37,38,54,32,12,52,54,
    61,743
CA  790 DATA 4,53,52,54,61,4,53,
    52,54,61,4,53,52,54,61,4,676

2F  800 DATA 53,54,32,8,100,101,
    54,32,10,100,101,54,32,4,40,
    19,794
46  810 DATA 54,32,28,40,19,32,3
    2,33,34,35,36,37,38,33,34,35
    ,552
CD  820 DATA 36,37,38,54,32,8,63
    ,64,61,53,52,54,61,4,53,52,7
    22
1D  830 DATA 54,61,4,53,52,54,61
    ,4,53,52,61,59,60,54,32,10,7
    24
9A  840 DATA 100,101,54,32,16,10
    0,101,54,32,16,100,101,54,32
    ,4,40,937
F8  850 DATA 19,54,32,16,40,87,2
    ,3,1,54,2,4,3,1,54,2,374
61  860 DATA 4,3,1,54,2,4,3,1,2,
    89,54,32,8,100,101,32,490
F0  870 DATA 32,26,27,28,29,30,3
    1,20,21,22,23,24,25,54,32,6,
    430
AF  880 DATA 52,54,61,4,53,52,54
    ,61,4,53,52,54,61,4,53,52,72
    4
70  890 DATA 54,61,4,53,54,32,8,
    100,101,54,32,10,100,101,54,
    32,850
CF  900 DATA 4,40,19,54,32,28,40
    ,19,32,32,26,27,28,29,30,31,
    471
1E  910 DATA 26,27,28,29,30,31,5
    4,32,7,63,64,61,61,53,52,54,
    672
23  920 DATA 61,4,53,52,54,61,4,
    53,52,54,61,4,53,52,61,61,74
    0
B2  930 DATA 59,60,32,20,21,22,2
    3,24,25,20,21,22,23,24,25,20
    ,441
55  940 DATA 21,22,23,24,25,20,2
    1,22,23,24,25,20,21,22,23,24
    ,360
8D  950 DATA 25,20,21,22,23,24,2
    5,54,32,8,100,101,54,32,4,40
    ,585
AE  960 DATA 19,54,32,16,86,7,7,
    8,6,54,7,4,8,6,54,7,375
F9  970 DATA 4,8,6,54,7,4,8,6,88
    ,19,54,32,8,100,101,54,553
CD  980 DATA 32,3,16,17,18,19,32
    ,32,16,17,18,19,54,32,7,66,3
    98
AB  990 DATA 54,61,4,67,66,54,61
    ,4,67,66,54,61,4,67,66,54,81
    0
98  1000 DATA 61,4,67,54,32,8,10
    0,101,54,32,10,100,101,54,32
    ,4,814
4B  1010 DATA 42,43,44,54,32,27,
    42,43,44,32,32,16,17,18,19,3
    2,537
2D  1020 DATA 32,16,17,18,19,54,
    32,7,90,64,54,61,3,67,66,54,
    654
37  1030 DATA 61,4,67,66,54,61,4
    ,67,66,54,61,4,67,66,54,61,8
    17
ED  1040 DATA 3,59,91,32,16,17,1
    8,19,32,32,16,17,18,19,32,32
    ,453
0F  1050 DATA 16,17,18,19,32,32,
    16,17,18,19,32,32,16,17,18,1
    9,338
13  1060 DATA 32,32,16,17,18,19,
    54,32,9,100,101,54,32,4,42,4
    3,605
B3  1070 DATA 44,54,32,38,42,43,
    44,32,32,2,2,3,1,54,2,4,429
D6  1080 DATA 3,1,12,13,14,15,3,
    1,12,13,14,15,3,1,54,2,176
34  1090 DATA 4,3,1,54,2,4,3,1,5
    4,2,4,3,1,54,2,4,196
CE  1100 DATA 3,1,54,2,4,3,1,54,
    2,4,3,1,54,2,4,3,195
2E  1110 DATA 1,54,2,4,3,1,54,2,
    4,3,1,2,45,19,54,32,281
76  1120 DATA 28,40,87,2,3,1,12,
    13,14,15,3,1,12,13,14,15,273

74  1130 DATA 3,1,54,2,4,3,1,54,
    2,4,3,1,54,2,4,3,195
72  1140 DATA 1,54,2,4,3,1,54,2,
    4,3,1,54,2,4,3,1,193
A9  1150 DATA 12,13,14,15,3,1,12
    ,13,14,15,3,1,12,13,14,15,17
    0
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CC   1160 DATA 3,1,12,13,14,15,3,
     1,12,13,14,15,3,1,12,13,145
A7   1170 DATA 14,15,3,1,54,2,4,3
     ,1,54,2,4,3,1,2,45,208
38   1180 DATA 19,54,32,39,40,87,
     3,1,2,7,7,8,6,54,7,4,370
0A   1190 DATA 8,6,54,7,4,8,6,54,
     7,4,8,6,54,7,4,8,245
18   1200 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
16   1210 DATA 54,7,4,8,6,54,7,4,
     8,6,54,7,4,8,6,54,291
97   1220 DATA 7,4,8,6,54,7,4,8,6
     ,7,7,46,54,32,28,86,364
60   1230 DATA 7,7,8,6,54,7,4,8,6
     ,54,7,4,8,6,54,7,247
C4   1240 DATA 4,8,6,54,7,4,8,6,5
     4,7,4,8,6,54,7,4,241
2E   1250 DATA 8,6,54,7,4,8,6,54,
     7,4,8,6,54,7,4,8,245
14   1260 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
8A   1270 DATA 54,7,4,8,6,54,7,4,
     8,6,54,7,4,8,6,54,291
0D   1280 DATA 7,4,8,6,7,7,46,54,
     32,39,86,7,8,6,7,7,331
FC   1290 DATA 32,86,7,8,6,7,54,3
     2,3,86,7,8,6,7,54,32,435
A7   1300 DATA 255,54,32,59,62,57
     ,65,56,57,58,54,32,100,47,54
     ,16,1058
1A   1310 DATA 3,54,32,19,56,54,5
     7,4,65,56,54,57,4,65,56,54,6
     90
1F   1320 DATA 57,4,65,56,57,58,5
     4,32,104,63,64,61,53,52,61,5
     9,900
49   1330 DATA 60,54,32,99,19,114
     ,117,16,54,32,19,52,54,61,4,
     53,840
F5   1340 DATA 52,54,61,4,53,52,5
     4,61,4,53,52,61,59,60,54,32,
     766
4D   1350 DATA 44,2,2,3,1,54,2,3,
     3,4,54,32,49,63,64,61,441
6C   1360 DATA 61,53,52,61,61,59,
     60,54,32,15,142,143,54,32,8,
     0,887
4F   1370 DATA 1,54,2,3,3,1,54,2,
     3,3,4,54,32,61,19,120,416
6F   1380 DATA 123,16,54,32,19,52
     ,54,61,4,53,52,54,61,4,53,52
     ,744
2E   1390 DATA 54,61,4,53,52,61,6
     1,59,60,54,32,43,7,7,8,6,622

2E   1400 DATA 54,7,3,8,9,54,32,4
     8,63,64,54,61,3,53,52,54,619

5D   1410 DATA 61,3,59,60,54,32,1
     4,140,141,54,32,8,5,6,54,7,7
     30
A5   1420 DATA 3,8,6,54,7,3,8,9,5
     4,32,61,48,19,19,47,54,432
88   1430 DATA 32,19,52,54,61,4,5
     3,52,54,61,4,53,52,54,61,4,6
     70
D4   1440 DATA 53,52,54,61,3,59,6
     0,54,32,63,20,21,22,23,24,25
     ,626
E6   1450 DATA 54,32,6,20,21,22,2
     3,24,25,54,32,18,52,54,61,4,
     502
0B   1460 DATA 53,52,54,61,4,53,5
     4,32,14,102,103,54,32,26,20,
     21,735
0B   1470 DATA 22,23,24,25,54,32,
     6,20,21,22,23,24,25,54,32,6,
     413
F8   1480 DATA 20,21,22,23,24,25,
     54,32,36,20,21,22,23,24,25,5
     4,446
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74   1490 DATA 32,6,52,54,61,4,53
     ,52,54,61,4,53,52,54,61,4,65
     7
82   1500 DATA 53,52,54,61,4,53,5
     4,32,64,16,17,18,19,54,32,8,
     591
09   1510 DATA 16,17,18,19,54,32,
     10,62,57,65,56,54,57,4,65,82
     ,668
16   1520 DATA 54,50,4,83,82,54,5
     0,4,83,54,32,14,100,101,54,3
     2,851
D5   1530 DATA 27,16,17,18,19,54,
     32,8,16,17,18,19,54,32,3,99,
     449
D3   1540 DATA 100,54,32,3,16,17,
     18,19,54,32,3,142,143,54,32,
     33,752
31   1550 DATA 16,17,18,19,54,32,
     7,82,54,50,4,83,82,54,50,4,6
     26
5A   1560 DATA 83,82,54,50,4,83,8
     2,54,50,4,83,56,57,58,54,32,
     886
A5   1570 DATA 60,33,34,35,36,37,
     38,54,32,6,33,34,35,36,37,38
     ,578
4B   1580 DATA 54,32,8,63,64,61,5
     3,52,54,61,4,53,52,54,61,4,7
     30
02   1590 DATA 53,52,54,61,4,53,5
     4,32,14,100,101,54,32,26,33,
     34,757
09   1600 DATA 35,36,37,38,54,32,
     6,33,34,35,36,37,38,32,32,10
     1,616
B7   1610 DATA 102,32,32,33,34,35
     ,36,37,38,32,32,140,141,54,3
     2,32,842
DB   1620 DATA 33,34,35,36,37,38,
     54,32,6,52,54,61,4,53,52,54,
     635
F8   1630 DATA 61,4,53,52,54,61,4
     ,53,52,54,61,4,53,52,61,59,7
     38
A6   1640 DATA 60,54,32,55,95,96,
     32,32,26,27,28,29,30,31,20,2
     1,668
F4   1650 DATA 22,23,24,25,26,27,
     28,29,30,31,54,32,7,63,64,61
     ,546
C4   1660 DATA 61,53,52,54,61,4,5
     3,52,54,61,4,53,52,54,61,4,7
     33
C0   1670 DATA 53,54,32,14,100,10
     1,54,32,26,26,27,28,29,30,31
     ,20,657
81   1680 DATA 21,22,23,24,25,26,
     27,28,29,30,31,20,21,22,23,2
     4,396
55   1690 DATA 25,26,27,28,29,30,
     31,32,32,102,103,54,32,32,26
     ,27,636
EE   1700 DATA 28,29,30,31,54,32,
     6,52,54,61,4,53,52,54,61,4,6
     05
94   1710 DATA 53,106,21,22,23,24
     ,107,52,54,61,4,53,52,61,61,
     59,813
52   1720 DATA 60,32,20,21,22,23,
     24,25,54,32,47,98,97,54,32,3
     ,644
75   1730 DATA 16,17,18,19,32,32,
     16,17,18,19,32,32,16,17,18,1
     9,338
F9   1740 DATA 54,32,7,90,64,54,6
     1,3,67,66,54,61,4,67,66,54,8
     04
98   1750 DATA 61,4,67,66,54,61,4
     ,67,54,32,14,100,101,54,32,2
     7,798
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97   1760 DATA 16,17,18,19,32,32,
     16,17,18,19,32,32,16,17,18,1
     9,338
29   1770 DATA 32,32,16,17,18,19,
     32,32,16,17,18,19,54,32,3,10
     0,457
35   1780 DATA 101,54,32,33,16,17
     ,18,19,54,32,7,66,54,61,4,67
     ,635
6E   1790 DATA 66,54,61,4,67,66,1
     6,17,18,19,67,66,54,61,4,67,
     707
D9   1800 DATA 66,54,61,3,59,91,3
     2,16,17,18,19,54,32,31,2,2,5
     57
AF   1810 DATA 3,1,54,2,4,3,1,54,
     2,4,3,1,54,2,4,3,195
01   1820 DATA 1,12,13,14,15,3,1,
     12,13,14,15,3,1,12,13,14,156

74   1830 DATA 15,3,1,54,2,4,3,1,
     54,2,4,3,1,54,2,4,207
2D   1840 DATA 3,1,54,2,4,3,1,54,
     2,4,3,1,54,2,4,3,195
DD   1850 DATA 1,54,2,4,3,1,54,2,
     4,3,1,54,2,4,3,1,193
E0   1860 DATA 54,2,4,3,1,54,2,4,
     3,1,54,2,4,3,1,12,204
2A   1870 DATA 13,14,15,3,1,12,13
     ,14,15,3,1,12,13,14,15,3,161

13   1880 DATA 1,12,13,14,15,3,1,
     12,13,14,15,3,1,54,2,4,177
FF   1890 DATA 3,1,54,2,4,3,1,54,
     2,4,3,1,54,2,4,3,195
19   1900 DATA 1,54,2,4,3,1,54,2,
     4,3,1,12,13,14,15,3,186
49   1910 DATA 1,54,2,4,3,1,54,2,
     4,3,1,54,2,4,3,1,193
EF   1920 DATA 12,13,14,15,3,1,54
     ,2,4,3,1,54,2,4,3,1,186
A1   1930 DATA 12,13,14,15,3,1,54
     ,2,4,3,1,54,2,4,3,1,186
2F   1940 DATA 54,2,4,3,54,32,12,
     7,7,8,6,54,7,4,8,6,268
DF   1950 DATA 54,7,4,8,6,54,7,4,
     8,6,54,7,4,8,6,54,291
0F   1960 DATA 7,4,8,6,54,7,4,8,6
     ,54,7,4,8,6,54,7,244
99   1970 DATA 4,8,6,54,7,4,8,6,5
     4,7,4,8,6,54,7,4,241
F3   1980 DATA 8,6,54,7,4,8,6,54,
     7,4,8,6,54,7,4,8,245
01   1990 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
21   2000 DATA 54,7,4,8,6,54,7,4,
     8,6,54,7,4,8,6,54,291
6D   2010 DATA 7,4,8,6,54,7,4,8,6
     ,54,7,4,8,6,54,7,244
53   2020 DATA 4,8,6,54,7,4,8,6,5
     4,7,4,8,6,54,7,4,241
4D   2030 DATA 8,6,54,7,4,8,6,54,
     7,4,8,6,54,7,4,8,245
DB   2040 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
DA   2050 DATA 54,7,4,8,6,54,7,4,
     8,6,54,7,4,8,6,54,291
DA   2060 DATA 7,4,8,6,54,7,4,8,6
     ,54,7,4,8,6,54,7,244
17   2070 DATA 4,8,54,32,9,54,0,1
     2,54,32,123,31,54,32,255,54,
     808
24   2080 DATA 32,255,54,32,133,1
     42,143,54,32,116,0,54,2,4,3,
     1,1057
39   2090 DATA 54,2,4,3,1,54,2,4,
     3,1,54,2,4,3,1,54,246
D6   2100 DATA 2,4,3,1,54,2,4,3,1
     ,54,2,4,3,1,54,2,194
34   2110 DATA 4,3,1,54,2,4,3,1,5
     4,2,4,3,1,54,2,4,196
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77  2120 DATA 4,54,32,71,140,141
    ,54,32,46,142,143,54,32,68,5
    ,54,1072
04  2130 DATA 7,4,8,6,54,7,4,8,6
    ,54,7,4,8,6,54,7,244
8C  2140 DATA 4,8,6,54,7,4,8,6,5
    4,7,4,8,6,54,7,4,241
A6  2150 DATA 8,6,54,7,4,8,6,54,
    7,4,8,6,54,7,4,8,245
D4  2160 DATA 6,54,7,4,9,54,32,7
    1,102,103,54,32,20,20,21,22,
    611
84  2170 DATA 23,24,25,20,21,22,
    23,24,25,20,21,22,23,24,25,2
    0,362
4A  2180 DATA 21,22,23,24,25,32,
    32,140,141,54,32,56,20,21,22
    ,23,688
07  2190 DATA 24,25,54,32,84,20,
    21,22,23,24,25,20,21,22,23,2
    4,464
60  2200 DATA 25,20,21,22,23,24,
    25,20,21,22,23,24,25,54,32,6
    ,387
33  2210 DATA 20,21,22,23,24,25,
    54,32,6,20,21,22,23,24,25,54
    ,416
D2  2220 DATA 32,11,100,101,54,3
    2,21,16,17,18,19,32,32,16,17
    ,18,536
68  2230 DATA 19,32,32,16,17,18,
    19,32,32,16,17,18,19,54,32,3
    ,376
66  2240 DATA 102,103,54,32,17,6
    2,57,65,56,54,57,4,65,56,54,
    57,895
1F  2250 DATA 4,65,56,54,57,4,65
    ,56,57,58,54,32,16,16,17,18,
    629
52  2260 DATA 19,54,32,9,142,143
    ,54,32,10,142,143,54,32,16,1
    42,143,1167
68  2270 DATA 54,32,22,142,143,5
    4,32,21,16,17,18,19,32,32,16
    ,17,667
19  2280 DATA 18,19,32,32,16,17,
    18,19,32,32,16,17,18,19,54,3
    2,391
3F  2290 DATA 8,16,17,18,19,54,3
    2,8,16,17,18,19,54,32,12,100
    ,440
B1  2300 DATA 101,54,32,20,33,34
    ,35,36,37,38,33,34,35,36,37,
    38,633
43  2310 DATA 33,34,35,36,37,38,
    33,34,35,36,37,38,32,32,100,
    101,691
0B  2320 DATA 54,32,16,63,64,61,
    53,52,54,61,4,53,52,54,61,4,
    738
3C  2330 DATA 53,52,54,61,4,53,5
    2,61,59,60,54,32,14,33,34,35
    ,711
7E  2340 DATA 36,37,38,54,32,8,1
    40,141,54,32,10,140,141,54,3
    2,16,965
DF  2350 DATA 140,141,54,32,22,1
    40,141,54,32,20,33,34,35,36,
    37,38,989
B5  2360 DATA 33,34,35,36,37,38,
    33,34,35,36,37,38,33,34,35,3
    6,564
0C  2370 DATA 37,38,54,32,6,33,3
    4,35,36,37,38,54,32,6,33,34,
    539
02  2380 DATA 35,36,37,38,54,32,
    11,100,101,32,32,20,21,22,23
    ,24,618
11  2390 DATA 25,54,32,12,26,27,
    28,29,30,31,26,27,28,29,30,3
    1,465
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EA  2400 DATA 26,27,28,29,30,31,
    26,27,28,29,30,31,20,21,22,2
    3,428
E3  2410 DATA 24,25,20,21,22,23,
    24,25,54,32,7,63,64,61,61,53
    ,579
91  2420 DATA 52,54,61,4,53,52,5
    4,61,4,53,52,54,61,4,53,52,7
    24
CE  2430 DATA 61,61,59,60,54,32,
    13,26,27,28,29,30,31,54,32,8
    ,605
2A  2440 DATA 102,103,54,32,10,1
    02,103,54,32,16,102,103,54,3
    2,22,102,1023
B7  2450 DATA 103,54,32,20,26,27
    ,28,29,30,31,26,27,28,29,30,
    31,551
D2  2460 DATA 26,27,28,29,30,31,
    26,27,28,29,30,31,54,32,6,26
    ,460
B1  2470 DATA 27,28,29,30,31,54,
    32,6,26,27,28,29,30,31,54,32
    ,494
BE  2480 DATA 11,100,101,54,32,3
    ,16,17,18,19,54,32,14,16,17,
    18,522
37  2490 DATA 19,32,32,16,17,18,
    19,32,32,16,17,18,19,32,32,1
    6,367
4C  2500 DATA 17,18,19,32,32,16,
    17,18,19,32,32,16,17,18,19,5
    4,376
C8  2510 DATA 32,7,90,64,54,61,3
    ,67,66,54,61,4,67,66,54,61,8
    11
09  2520 DATA 4,67,66,54,61,4,67
    ,66,54,61,3,59,91,54,32,13,7
    56
76  2530 DATA 16,17,18,19,54,32,
    9,100,101,54,32,10,100,101,5
    4,32,749
54  2540 DATA 16,100,101,54,32,2
    2,100,101,54,32,21,16,17,18,
    19,32,735
8A  2550 DATA 32,16,17,18,19,32,
    32,16,17,18,19,32,32,16,17,1
    8,351
33  2560 DATA 19,54,32,8,16,17,1
    8,19,54,32,8,16,17,18,19,54,
    401
CD  2570 DATA 32,10,1,54,2,4,3,1
    ,12,13,14,15,3,1,54,2,221
E0  2580 DATA 4,3,1,54,2,4,3,1,1
    2,13,14,15,3,1,12,13,155
14  2590 DATA 14,15,3,1,12,13,14
    ,15,3,1,12,13,14,15,3,1,149
86  2600 DATA 12,13,14,15,3,1,12
    ,13,14,15,3,1,54,2,4,3,179
E6  2610 DATA 1,54,2,4,3,1,54,2,
    4,3,1,54,2,4,3,1,193
3D  2620 DATA 54,2,4,3,1,54,2,4,
    3,1,54,2,4,3,1,54,246
26  2630 DATA 2,4,3,1,12,13,14,1
    5,3,1,54,2,4,3,1,54,186
E8  2640 DATA 2,4,3,1,54,2,4,3,1
    ,54,2,4,3,1,54,2,194
3A  2650 DATA 4,3,1,54,2,4,3,1,5
    4,2,4,3,1,54,2,4,196
74  2660 DATA 3,1,54,2,4,3,1,54,
    2,4,3,1,54,2,4,3,195
72  2670 DATA 1,54,2,4,3,1,54,2,
    4,3,1,54,2,4,3,1,193
A9  2680 DATA 12,13,14,15,3,1,12
    ,13,14,15,3,1,12,13,14,15,17
    0
2E  2690 DATA 3,1,12,13,14,15,3,
    1,54,2,4,3,1,12,13,14,165
FE  2700 DATA 15,3,1,54,2,4,3,1,
    12,13,14,15,3,54,32,9,235
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A4  2710 DATA 6,54,7,4,8,6,54,7,
    4,8,6,54,7,4,8,6,243
FA  2720 DATA 54,7,4,8,6,54,7,4,
    8,6,54,7,4,8,6,54,291
3A  2730 DATA 7,4,8,6,54,7,4,8,6
    ,54,7,4,8,6,54,7,244
C6  2740 DATA 4,8,6,54,7,4,8,6,5
    4,7,4,8,6,54,7,4,241
F8  2750 DATA 8,6,54,7,4,8,6,54,
    7,4,8,6,54,7,4,8,245
06  2760 DATA 6,54,7,4,8,6,54,7,
    4,8,6,54,7,4,8,6,243
E4  2770 DATA 54,7,4,8,6,54,7,4,
    8,6,54,7,4,8,6,54,291
38  2780 DATA 7,4,8,6,54,7,4,8,6
    ,54,7,4,8,6,54,7,244
70  2790 DATA 4,8,6,54,7,4,8,6,5
    4,7,4,8,6,54,7,4,241
5A  2800 DATA 8,6,54,7,4,8,6,54,
    7,4,8,6,54,7,4,8,245
48  2810 DATA 6,54,7,4,8,6,54,7,
    4,8,6,54,7,4,8,6,243
A9  2820 DATA 54,7,4,8,6,54,7,4,
    8,6,54,7,4,8,6,54,291
B9  2830 DATA 7,4,8,6,54,7,4,8,6
    ,54,7,4,8,54,32,9,272
3F  2840 DATA 54,0,12,54,32,255,
    54,32,45,62,57,65,56,57,58,5
    4,947
06  2850 DATA 32,248,63,64,61,53
    ,52,61,59,60,54,32,246,63,64
    ,61,1273
91  2860 DATA 61,53,52,61,61,59,
    60,54,32,222,142,143,54,32,2
    0,63,1169
FC  2870 DATA 64,54,61,3,53,52,5
    4,61,3,59,60,54,32,12,98,54,
    774
9B  2880 DATA 255,4,99,54,32,189
    ,20,21,22,23,24,25,54,32,8,1
    40,1002
B6  2890 DATA 141,54,32,20,52,54
    ,61,4,53,52,54,61,4,53,54,32
    ,781
52  2900 DATA 13,74,75,136,137,5
    4,32,191,16,17,18,19,54,32,9
    ,102,979
AB  2910 DATA 103,54,32,17,62,57
    ,65,82,54,50,4,51,49,54,50,4
    ,788
3B  2920 DATA 83,56,57,58,54,32,
    10,74,75,136,137,54,32,190,3
    3,34,1115
49  2930 DATA 35,36,37,38,54,32,
    8,100,101,54,32,16,63,64,61,
    53,784
03  2940 DATA 52,54,61,4,53,52,5
    4,61,4,53,52,61,59,60,54,32,
    766
2A  2950 DATA 9,74,75,136,137,54
    ,32,190,26,27,28,29,30,31,20
    ,21,919
45  2960 DATA 22,23,24,25,20,21,
    22,23,24,25,20,21,22,23,24,2
    5,364
E3  2970 DATA 54,32,7,63,64,61,6
    1,53,52,54,61,4,53,52,54,61,
    786
FD  2980 DATA 4,53,52,61,61,59,6
    0,54,32,8,74,75,136,137,54,3
    2,952
83  2990 DATA 191,16,17,18,19,32
    ,32,16,17,18,19,32,32,16,17,
    18,510
56  3000 DATA 19,32,32,16,17,18,
    19,54,32,7,90,64,54,61,3,67,
    585
3C  3010 DATA 66,54,61,4,67,66,5
    4,61,4,67,66,54,61,3,59,91,8
    38
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D3   3020 DATA 54,32,7,74,75,136,
     137,54,32,184,1,54,2,4,3,1,8
     50
44   3030 DATA 12,13,14,15,3,1,12
     ,13,14,15,3,1,12,13,14,15,17
     0
18   3040 DATA 3,1,12,13,14,15,3,
     1,54,2,4,3,1,54,2,4,186
D3   3050 DATA 3,1,54,2,4,3,1,54,
     2,4,3,1,54,2,4,3,195
3D   3060 DATA 1,54,2,4,3,1,72,73
     ,134,135,3,1,54,2,3,10,552
35   3070 DATA 54,32,178,6,54,7,4
     ,8,6,54,7,4,8,6,54,7,489
DC   3080 DATA 4,8,6,54,7,4,8,6,5
     4,7,4,8,6,54,7,4,241
16   3090 DATA 8,6,54,7,4,8,6,54,
     7,4,8,6,54,7,4,8,245
1C   3100 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
97   3110 DATA 54,7,3,11,54,32,17
     8,54,0,12,54,234,3,32,0,192,
     920
D3   3120 DATA 169,63,141,65,56,1
     69,68,141,66,56,169,73,141,6
     7,56,160,1660
03   3130 DATA 5,173,65,56,153,23
     1,64,206,65,56,173,66,56,153
     ,15,65,1602
CE   3140 DATA 206,66,56,173,67,5
     6,153,55,65,206,67,56,169,25
     5,153,55,1858
39   3150 DATA 217,153,15,217,153
     ,231,216,136,208,215,96,58,6
     3,68,54,0,2100
63   3160 DATA 255,54,0,255,54,0,
     255,54,0,255,54,0,255,54,0,2
     55,1800
88   3170 DATA 54,0,255,54,0,194,
     148,32,32,20,8,9,19,32,9,19,
     885
18   3180 DATA 32,20,8,5,32,19,16
     ,1,3,5,32,23,8,5,18,5,232
30   3190 DATA 32,25,15,21,18,32,
     20,9,20,12,5,54,32,6,148,136
     ,585
90   3200 DATA 137,147,32,137,147
     ,32,148,136,133,32,147,144,1
     29,131,133,32,1797
D2   3210 DATA 151,136,133,146,13
     3,32,153,143,149,146,32,148,
     137,148,140,133,2060
1F   3220 DATA 54,32,47,15,18,32,
     19,3,15,18,5,32,3,1,14,32,34
     0
9E   3230 DATA 2,5,32,19,1,6,5,12
     ,25,32,4,9,19,16,12,1,200
13   3240 DATA 25,5,4,54,32,8,143
     ,146,32,147,131,143,146,133,
     32,131,1312
A1   3250 DATA 129,142,32,130,133
     ,32,147,129,134,133,140,153,
     32,132,137,147,1882
BA   3260 DATA 144,140,129,153,13
     3,132,54,32,37,59,60,61,62,6
     3,54,32,1345
5E   3270 DATA 35,64,65,66,67,68,
     54,32,35,69,70,71,72,73,54,3
     2,927
1C   3280 DATA 13,241,245,32,32,2
     41,245,54,32,18,241,245,54,3
     2,4,241,1970
8C   3290 DATA 245,241,245,241,24
     5,54,32,3,238,243,248,252,23
     8,243,247,252,3267
C5   3300 DATA 32,32,241,245,54,3
     2,6,241,245,54,32,4,238,242,
     246,252,2196
28   3310 DATA 32,32,241,239,251,
     242,246,254,243,245,32,238,2
     39,243,247,250,3274
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04   3320 DATA 254,243,243,250,24
     5,238,242,246,252,54,32,4,23
     8,239,243,245,3268
9C   3330 DATA 241,245,238,239,24
     3,247,250,252,238,239,249,23
     6,244,248,250,254,3913
4D   3340 DATA 248,253,236,240,24
     4,248,250,250,254,243,248,25
     1,240,244,248,250,3947
1A   3350 DATA 252,233,234,235,23
     6,240,244,248,237,251,236,24
     0,244,248,250,250,3878
4F   3360 DATA 254,249,54,232,40,
     57,58,54,231,17,142,143,54,2
     31,16,142,1974
36   3370 DATA 143,231,61,59,60,5
     4,230,16,140,141,54,230,16,1
     40,141,230,1946
FA   3380 DATA 61,61,59,60,54,227
     ,15,102,103,54,227,16,102,10
     3,227,54,1525
4A   3390 DATA 61,3,59,60,54,32,1
     4,100,101,54,32,16,100,101,3
     2,54,873
12   3400 DATA 61,4,53,54,229,14,
     100,101,54,229,16,100,101,22
     9,54,50,1449
8D   3410 DATA 4,83,56,57,58,54,3
     2,11,100,101,54,32,16,100,10
     1,32,891
10   3420 DATA 54,61,4,53,52,61,5
     9,60,54,32,10,100,101,54,32,
     16,803
AE   3430 DATA 100,101,32,54,61,4
     ,53,52,61,61,59,60,32,20,21,
     22,793
F7   3440 DATA 23,24,25,20,21,22,
     23,24,25,20,21,22,23,24,25,2
     0,362
92   3450 DATA 21,22,23,24,25,20,
     21,22,23,24,54,61,4,67,66,54
     ,531
15   3460 DATA 61,3,59,91,228,16,
     17,18,19,228,228,16,17,18,19
     ,228,1266
92   3470 DATA 228,16,17,18,19,22
     8,228,16,17,18,19,228,228,16
     ,17,18,1331
C3   3480 DATA 19,54,2,4,3,1,54,2
     ,4,3,1,12,13,14,15,3,204
A5   3490 DATA 1,12,13,14,15,3,1,
     12,13,14,15,3,1,12,13,14,156
09   3500 DATA 15,3,1,12,13,14,15
     ,54,7,4,8,6,54,7,4,8,225
7F   3510 DATA 6,54,7,4,8,6,54,7,
     4,8,6,54,7,4,8,6,243
7F   3520 DATA 54,7,4,8,6,54,7,4,
     54,32,40,2,3,4,5,6,290
21   3530 DATA 7,8,9,10,11,12,13,
     14,15,16,17,18,17,25,21,22,2
     35
78   3540 DATA 54,0,5,149,0,5,191
     ,0,25,63,0,67,127,0,129,239,
     1054
46   3550 DATA 0,0,207,2,2,255,4,
     0,191,0,1,255,16,35,255,16,1
     239
73   3560 DATA 7,255,32,131,239,0
     ,17,255,64,5,255,64,83,255,0
     ,41,1703
F1   3570 DATA 255,138,79,127,1,1
     47,143,130,42,39,5,135,243,1
     28,46,153,1811
72   3580 DATA 128,54,0,3,224,0,0
     ,232,0,0,254,0,0,254,128,0,1
     277
29   3590 DATA 255,192,0,191,224,
     0,255,224,0,255,240,0,255,24
     0,0,247,2578
54   3600 DATA 248,0,255,124,0,25
     5,156,0,255,222,0,223,188,0,
     111,254,2291
```

```
4A   3610 DATA 0,255,254,0,255,25
     5,0,255,239,0,255,231,0,255,
     254,0,2508
03   3620 DATA 255,64,71,230,2,19
     ,8,64,7,112,0,13,128,32,1,0,
     1006
21   3630 DATA 16,54,0,6,1,0,4,0,
     132,54,0,3,1,0,8,0,279
BB   3640 DATA 0,1,0,32,1,0,8,0,0
     ,1,54,0,3,53,54,0,207
06   3650 DATA 15,15,111,202,0,31
     ,182,0,15,38,0,13,20,0,59,10
     0,801
F0   3660 DATA 0,33,168,0,66,232,
     0,129,112,0,4,0,0,3,32,0,779
82   3670 DATA 66,64,0,5,0,0,6,0,
     0,24,0,0,224,54,0,25,468
11   3680 DATA 16,0,1,54,0,3,16,0
     ,0,16,0,0,16,0,0,16,138
37   3690 DATA 0,0,146,0,0,84,0,0
     ,56,0,7,255,192,0,56,0,796
61   3700 DATA 0,84,0,0,146,0,8,1
     6,0,0,16,0,0,16,54,0,340
0A   3710 DATA 3,128,0,16,54,0,5,
     16,54,0,10,8,54,0,30,8,386
3F   3720 DATA 54,0,13,64,54,0,13
     ,4,54,0,16,8,54,0,9,1,344
A8   3730 DATA 54,0,22,64,54,0,9,
     240,54,0,9,32,54,0,7,16,615
35   3740 DATA 54,0,12,1,54,0,28,
     16,54,0,3,12,54,0,9,48,345
2A   3750 DATA 54,0,7,16,54,0,12,
     1,54,0,28,24,54,0,255,54,613
E5   3760 DATA 0,255,54,0,255,54,
     0,255,54,0,255,54,0,255,54,0
     ,1545
8F   3770 DATA 255,54,0,255,54,0,
     255,54,0,214,124,254,0,198,1
     98,0,1915
41   3780 DATA 254,0,248,252,0,20
     4,204,0,252,0,124,254,0,198,
     198,0,2188
C6   3790 DATA 192,0,252,254,0,19
     8,198,0,198,0,254,254,0,192,
     192,0,2184
43   3800 DATA 248,0,254,254,0,19
     2,192,0,248,0,124,254,0,198,
     192,0,2156
EA   3810 DATA 158,0,198,198,0,19
     8,198,0,254,0,254,254,0,24,2
     4,0,1760
E4   3820 DATA 24,0,126,126,0,24,
     24,0,24,0,198,198,0,204,204,
     0,1152
AD   3830 DATA 240,0,192,192,0,19
     2,192,0,192,0,130,198,0,238,
     238,0,2004
3B   3840 DATA 186,0,198,198,0,23
     0,230,0,246,0,124,254,0,198,
     198,0,2062
88   3850 DATA 198,0,252,254,0,19
     8,198,0,254,0,124,254,0,198,
     198,0,2128
D9   3860 DATA 198,0,248,252,0,20
     4,204,0,252,0,124,254,0,198,
     192,0,2126
8B   3870 DATA 252,0,126,126,0,24
     ,24,0,24,0,198,198,0,198,198
     ,0,1368
BA   3880 DATA 198,0,198,198,0,19
     8,198,0,198,0,198,198,0,198,
     198,0,1980
AC   3890 DATA 214,0,198,198,0,10
     8,108,0,56,0,198,198,0,198,1
     98,0,1674
62   3900 DATA 124,0,254,254,0,12
     ,12,0,48,54,0,169,24,24,0,24
     8,1223
A2   3910 DATA 248,0,24,0,124,254
     ,0,198,6,0,126,0,124,254,0,1
     98,1556
```

```
5C   3920 DATA 6,0,60,0,48,48,0,9
     6,96,0,204,0,254,254,0,192,1
     258
3D   3930 DATA 192,0,252,0,124,25
     4,0,198,192,0,252,0,254,254,
     0,12,1984
35   3940 DATA 12,0,24,0,124,254,
     0,198,198,0,124,0,124,254,0,
     198,1510
5E   3950 DATA 198,0,254,0,124,25
     4,0,198,198,0,198,54,0,20,5,
     25,1528
44   3960 DATA 67,129,54,0,3,21,1
     91,63,127,239,54,0,4,224,232
     ,254,1662
B6   3970 DATA 254,54,0,9,2,4,0,1
     6,16,32,0,0,2,0,1,35,425
95   3980 DATA 7,131,17,207,255,1
     91,54,255,3,239,255,255,191,
     54,255,3,2372
C3   3990 DATA 247,255,255,192,22
     4,240,240,248,252,124,158,64
     ,64,0,138,1,2702
A4   4000 DATA 130,5,128,5,83,41,
     79,147,42,135,46,54,255,3,12
     7,143,1423
4E   4010 DATA 39,243,153,255,223
     ,111,127,143,39,243,153,222,
     188,255,254,255,2903
EA   4020 DATA 239,231,254,54,0,4
     ,3,54,0,8,6,54,0,3,12,54,976

A5   4030 DATA 0,9,24,54,0,11,3,5
     4,0,6,96,54,0,5,192,54,562
81   4040 DATA 0,255,54,0,132,254
     ,0,198,198,0.198,198,0,254,0
     ,198,1939
C2   4050 DATA 198,0,254,252,0,19
     2,0,198,198,0,254,124,0,198,
     0,198,2066
F8   4060 DATA 198,0,254,252,0,24
     8,0,192,192,0,254,254,0,248,
     0,192,2284
B3   4070 DATA 192,0,192,192,0,15
     8,0,198,198,0,254,118,0,254,
     0,198,1954
4B   4080 DATA 198,0,198,198,0,24
     ,0,24,24,0,254,254,0,24,0,21
     6,1414
8B   4090 DATA 216,0,248,112,0,24
     0,0,204,204,0,198,198,0,192,
     0,192,2004
3B   4100 DATA 192,0,254,254,0,18
     6,0,198,198,0,198,198,0,222,
     0,206,2106
0F   4110 DATA 206,0,198,198,0,19
     8,0,198,198,0,254,124,0,252,
     0,192,2018
25   4120 DATA 192,0,192,192,0,19
     8,0,218,218,0,246,118,0,248,
     0,204,2026
FD   4130 DATA 204,0,198,198,0,12
     6,0,6,198,0,254,124,0,24,0,2
     4,1356
D5   4140 DATA 24,0,24,24,0,198,0
     ,198,198,0,254,124,0,198,0,1
     08,1350
E6   4150 DATA 108,0,56,56,0,186,
     0,238,238,0,198,130,0,56,0,1
     08,1374
BF   4160 DATA 108,0,198,198,0,60
     ,0,24,24,0,24,24,0,48,0,96,8
     04
DF   4170 DATA 96,0,254,254,54,0,
     169,24,0,24,24,0,254,254,0,2
     52,1659
38   4180 DATA 0,192,192,0,254,25
     4,0,60,0,6,198,0,254,124,0,2
     04,1738
AA   4190 DATA 0,254,254,0,12,12,
     0,254,0,6,198,0,254,124,0,25
     4,1622
B3   4200 DATA 0,198,198,0,254,12
     4,0,24,0,48,48,0,48,48,0,254
     ,1244
E3   4210 DATA 0,198,198,0,254,12
     4,0,126,0,6,198,0,254,124,0,
     198,1680
64   4220 DATA 0,198,198,0,254,12
     4,54,0,255,54,0,107,255,0,0,
     255,1754
52   4230 DATA 54,0,3,85,181,176,
     176,186,191,170,170,0,2,11,1
     0,43,1458
F4   4240 DATA 174,171,186,0,192,
     240,240,252,252,255,255,2,2,
     10,10,42,2283
2D   4250 DATA 42,170,234,54,170,
     8,234,234,250,250,254,254,25
     5,255,2,2,2668
90   4260 DATA 10,10,42,42,54,170
     ,3,171,170,170,171,174,170,1
     71,186,171,1885
C6   4270 DATA 170,238,170,187,17
     4,186,2,2,11,10,43,42,174,17
     1,174,175,1929
56   4280 DATA 187,171,174,171,18
     7,238,187,174,235,251,174,23
     5,187,174,239,187,3171
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Competition Winners

Peagus

Find out if you're one of the lucky winners in the Peagus competition from November 1987. Read on:

Adrian Patterson, Dorchester; Peter Dent, Seaham; B.B.H. Geitenbeek, Den Helder, Netherlands; G. Tsangarakis, London SW1; W.E. Price, Basildon; K. Magras, London E13; G.R. Davies, Radford; Chris Garbutt, Basildon; K.R. Blackwell, Chatham; Lars Hammarstedt, Hornefors, Sweden; Robert Tomlinson, Nykvarn, Sweden; Richard Walker, Sedgley, West Midlands; Rashid Qureshi, Karachi, Pakistan; Wal Tan Tse, Birchwood; D. Cook, Blackpool; James Laidlaw, Hykeham, Lincoln; M. Lyon, Plymouth; G. Renton, Ryde, I.O.W.; Nicholas Wright, Preston; J. Alrajoodi, Mid Glamorgan; John Consadine, N. Ferriby, North Humberside; John Wootton, Eastbourne; M.E. Ventham, Radlett, Herts; Sacha Dawes, Lewes; Eyal Teler, Jerusalem, Andrew Cobb, Sawbridgenorth, Herts; Stephen Citrone, Washingtone, Tyne & Wear; W.R. Austin, Pennycross, Plymouth.

Football Manager II

Well the lucky winner of our Spot the Ball competition which we ran in the December issue of *Your Commodore* is Mr R. Nickels from Paignton, Devon. Mr Nickels will have the chance to take part in a game of Football Manager II against three competition winners from other magazines. The overall winner of this game wins a trip to see the European Football Championship finals in Munich in June 1988. Good Luck! Mr Nickels also wins a video of the 1966 World Cup, as does Martin Gingles, Glasgow; Xohei Kurgyanagi, Pinner; D. Kaosch, Abingdon; Edward Newiss, Keighley.

Konix Joystick

Have you won the revised Konix joystick as a result of our competition in the January issue? Read on and find out.

T. Preston, Kiolington, Oxford; M. Eves, Norwich; A.J. Spiby, Burton-on-Sea; Rachel Longson, Chesterfield; Bryan Lewis, Redcar; Dave Parish, West Wickham; Graeme Gibson, Durham; K. Williamson, London, E17; Norman Stone, Chelmsford; Darren Nolan, Weston, Southampton.

Hunt for Red October

Find out if you're one of the lucky winners in the Hunt for Red October competition from February 1988. Read on:

J.A.G. Airlie, London; N. Streeter, London; Stephen Bourke, Chester; Bo-Goran Skansen, Sweden; K. Taylor, Barnsley; Landreau François, France; G.D. Hudson, Essex; J.P. Rankin, Birmingham; F. Eastman, Northumbria; P. Fullwood, West Midlands.

Bug Finder

We'd like to remind our readers that we run a Bug Finder service.

If you have typed in one of our programs and despite much checking, you still can't get it to run, then send us the following:

Two copies of your program on tape or disk.
A description of your problem.
If possible a listing of your work (you may omit this).
A stamped, self-addressed envelope for return of the program to you.

Should any of the above be missing then we will not be able to deal with your query.

We will try to point out where you have made errors and place a corrected copy of the program back on to your tape or disk before we return it to you.

Do not send a program to us as soon as it stops working, please check it several times first.

We do get a large number of queries and so it may take a while for us to deal with yours personally.

Note: we can only deal with problems relating to programs published in *Your Commodore*.

Program Submissions

Due to the illness of our software evaluator some people may be experiencing a delay in getting to replies regarding submissions. We are trying to clear the backlog of programs as quickly as we can but this is taking some time. This backlog also effects Bug Finders and Lifesavers.

We apologise for the delay and would ask that you would bear with us while the backlog is cleared.

The publication of lifesavers has also been halted because of this software backlog. We will be bringing you more short programs and tips as soon as we can.

Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U.K. Many people, after referring to their computer manuals, believe them to be based in Corby.

The Commodore plant at Corby was closed down some time ago. Reproduced here you will find the correct address for Commodore U.K.

We suggest that you write this correct address in the front of your computers manual for future reference.

Commodore Business Machine, (UK),
Commodore House,
The Switchback,
Gardner Road,
Maidenhead,
Berks SL6 7XA.

At the *Your Commodore* office we receive hundreds of letters from readers every month. We do try and answer each individually but sometimes this is impossible due to pressure of work. If you have written to us and not received a personal reply, we apologise for this but we cannot promise to reply to every item of mail we receive. If you feel that your question or letter really needs an answer, then inclusion of an s.a.e. will guarantee a reply, although this may still take time to arrive.

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